JOURNAL

OF THE

Department of Agriculture

OF

WESTERN AUSTRALIA.

Vol. 11. (Second Series) SEPTEMBER, 1934. No. 3.

THE LAMB FOR EXPORT.

Experiments at the Avondale Experiment Farm.

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With the object of fostering the export lamb industry in order to relieve the depressed condition of the sheep industry and dispose of our surplus sheep, an honorary consultative committee was formed in 1929. This committee consisted of Messrs. E. H. Lefroy, "Cranmore Park," Walebing; W. G. Burges, "Tipperary," York; W. Marwick, York; W. Anderson, Beverley; C. Felstead, Pingelly; I. Thomas (Superintendent of Wheat Farms); H. McCallum (Sheep and Wood Inspector); with Mr. Geo. L. Sutton (Director of Agriculture) as chairman, and Mr. N. Davenport (Agricultural Adviser) as secretary. The function of the committee was to formulate tentative recommendations for the guidance of prospective lamb raisers, and which would be advocated by the Department until more definite information could be obtained from experiments to be carried out.

It was ascertained that the greatest demand on the London market was for a sucker lamb, weighing from 28-36 lbs. A description of the best export lamb may be set out as follows:—The carcase should be compact and symmetrical, and its general appearance light and bright rather than dark or yellowish; it must also be sappy and fresh and not dry, evenly coated with flesh, but not over fat; the fat should be white and well distributed throughout the body, and showing clearly under the tissues, so that the flesh beneath is more or less completely hidden. Particularly must this be the case on the hind-quarters and points of the withers. This covering of fat is technically known as the "selvedge," and gives to the carcase what is known as the "bloom" or "finish." The body should be well rounded with a broad back, full in the buttocks, producing a U-shaped arch rather than the V-shaped lankiness. The shoulders and flanks should also be full, with light bone, thick neck and meat down to the knees and hocks.

It was decided, after exhaustive inquiry and a study of the results of experiments carried out in other parts of the Commonwealth and New Zealand, that, under West Australian conditions, the type of lamb most likely to meet the requirements of the export lamb referred to would be procured by the use of rams of the Dorset Horn, Shropshire, and Southdown breeds, mated with Merino ewes or with half-bred ewes resulting from the mating of British breed Longwool rams with the Merino ewe. The prospective lamb breeders were advised accordingly, but, in order to be in a position to advocate standardised breeding methods as the result of obtaining more definite information under West Australian conditions regarding the relative suitability of the three breeds of rams, Dorset Horn, Shropshire, and Southdown, it was decided to conduct experiments with representative rams of each of these breeds.

It was considered that half-bred ewes of any of the Longwool breeds—Lincoln, Leicester, Romney Marsh or Border Leicester—would be satisfactory mothers for mating with the short-wool rams of the Down type for the production of export lambs. Border Leicester half-bred ewes were, however, used in this experiment as representing the desired type, and because they were available and being bred at the Wongan Hills Departmental Farm. It was decided to conduct the experiments referred to at the Avondale Experiment Farm, the manager of which—Mr. H. J. Bailey—carried out the field work associated with this experiment. Concurrently with the experiments at the Avondale Farm, similar experiments were initiated on the property of Mr. W. G. Burges, "Tipperary," in the York district.

The Avondale Farm is well adapted for stock raising and fattening, and is situated in typical lamb raising country, 4½ miles west of Beverley township, on the Great Southern Railway, and is distant 99 miles by rail from Perth. It is thus within handy railing distance—114 miles—from the W.A. Meat Export Company's works at Robb's Jetty, where the lambs intended for export are treated. The Farm comprises 1,800 acres of undulating and broken country. The soil, as is usual in this district, shows considerable variation from light sandy to red clay loams, the latter predominating.

Seasonal Characteristics.

In normal years the real winter rains commence in May, though it is not unusual for rains to fall in April or, on occasion, even as early as March. These early rains are usually followed by dry weather, but may be sufficient to provide short green picking of natural pasture, and to germinate the seed of fodder crops sown on well-prepared fallow land. It is not usual for natural green pasture to be plentiful until June, but from then onwards until the end of October, natural green feed is abundant. Natural pasture then matures and becomes dry, and during the summer and early autumn no green feed is available. During the late summer, in common with district practice, it is customary to supplement the natural feed with a small ration of conserved food, such as oaten or wheaten hay, oaten grain, and, when available, with silage or a mixture of two or three of these.

Observation during this experiment emphasised that it is essential to provide ample succulent feed for the ewe after lambing, and that, if suitable natural feed is not available, provision for supplementing the shortage should be met by the growth of suitable fodder crops.

In 1931, the first year the experimental lambs were dropped, the natural feed was scarce until late in June, and, in consequence, the usual supplementary

autumn feeding of the ewes was extended later than usual and until the third week in June. On July 25th, the ewes and lambs were turned into a fodder crop of oats planted for the purpose.

The following season—1932—natural feed was not available until June, and from then on was plentiful. In order to provide early grazing prior to the natural feed becoming available—normally in June—a crop of oats and rape was planted in March. The rains in April and May caused the seed to germinate; fair growth resulted and was available for the ewes after they lambed.

In 1933, early natural feed conditions were again poor until late in June. However, a good fall of rain in March, of 199 points, was sufficient to bring along a crop of rape and oats which had been planted and on which ewes, after lambing, were pastured. There was sufficient rain for the fodder crop to make satisfactory growth.

The following table gives the monthly rainfalls at the Farm for the years 1930-33 (inclusive), together with the averages for the seven years ended 1933:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1930 ...	...	5	62	153	44	554	619	258	81	35	1,591	...	95	1,906
1931 ...	...	4	43	93	300	172	320	477	325	44	1,638	...	73	1,851
1932 ...	15	...	14	147	553	155	453	416	42	447	2,066	...	37	2,243
1933 ...	30	12	199	27	360	316	198	189	79	143	1,285	...	...	1,553
Av. 7 years	13	22	106	78	255	299	386	279	122	125	1,466	33	29	1,749

THE EXPERIMENTAL FLOCKS.

The half-bred ewes (Border Leicester-Merino) used in the experiment were bred at and obtained from the Wongan Hills Departmental Farm, and the Merino ewes were originally from the North-West pastoral areas, and had been purchased and sent to the Avondale Farm for fattening and sale. The foundation half-bred ewes were four and two tooths, and these were added to each year by more two-tooth ewes from the Wongan Hills Farm.

Both the half-bred and Merino ewes were divided into three equal lots. One lot of each type of ewe was mated with Dorset Horn rams, another lot of each type with Shropshire rams, and the remaining lot of each type with Southdown rams. There were thus three groups of experimental ewes, each containing both half-bred and Merino ewes.

Every ewe in each group was branded with the same identification mark; this was done so as to enable all experimental ewes to be "boxed" after mating and pastured together as one flock. so that identical grazing conditions would obtain for all.

The rams were joined with the ewes at night only, and were separated from them during the day, kept in a small yard and hand fed. After two months the rams were removed and the ewes were run as one flock.

TIME OF MATING.

For the first year the ewes were mated on the 15th December, but, in the following years, it was decided to advance the mating by a month, and, in consequence, in those years the ewes were mated in the middle of November. During the mating period the pasturing arrangements were such that each group of ewes had similar feed throughout. This was achieved by arranging that each group of ewes should be grazed in the same paddocks regularly and in rotation.

The numerical composition of the respective groups is shown in the following table:—

TABLE 1.

Breed of Ram.	Breed of Ewe.	Number of Ewes Mated.		
		1931.	1932.	1933.
Dorset Horn ...	Border Leicester-Merino ...	27	54	90
	Merino	27	30	...
Shropshire	Border Leicester-Merino ...	27	54	89
	Merino	27	30	...
Southdown	Border Leicester-Merino	27	53	89
	Merino	27	30	...
Total all Rams...	Border Leicester-Merino ...	81	161	268
	Merino	81	90	...
	Total all Ewes ...	162	251	268

LAMBING DETAILS.

All lambs were weighed at birth, at intervals throughout their growth, and again immediately prior to trucking to the freezing works. A numbered ear tag was inserted at birth and also a body brand corresponding to the group brand of the mother. In this way a complete weight and age history of each lamb was obtained up to the time of slaughter. As the pelt was removed from each lamb on the killing floor, a cardboard tag, bearing the same number as the ear tag, was affixed to the gambrel suspending the carcase, and thus the history was made more complete by being able to ascertain each carcase weight and the grade to which each was allocated. It thus became possible to determine for each lamb, as marketed, its age, birth, weight, farm weight, prior to despatch, carcase weight and the grade of the carcase, as well as its breeding.

In 1931, lambing commenced on May 19th, but did not become general until about June 2nd. In the two following years, as a result of mating the ewes a month earlier, lambing, except in the case of the Shropshire crosses, commenced in both years about April 26th. In the 1933 drop, the Shropshire crosses commenced to drop rather late, and a greater proportion were dropped during June than lambs with the Dorset Horn and Southdown as sires. The lambs were marked when from 10 to 14 days old.

The lambing returns for all crosses for the three years are shown below:—

TABLE 2.—INFLUENCE OF THE RAM ON THE FECUNDITY OF THE EWES.

Particulars of Drop—1931, 1932 *and* 1933.

Breed of Ram.	Year.	Percentage Lambs marked—		
		Border Leicester-Merino Ewe.	Merino Ewe.	Total all Ewes.
		%	%	%
Dorset Horn	1931	70	56	63
	1932	50	70	57
	1933	56	...	56
	All years ...	56	63	57
Shropshire	1931	37	78	57
	1932	80	80	80
	1933	79	...	79
	All years ...	72	79	74
Southdown	1931	22	70	46
	1932	74	73	74
	1933	83	...	83
	All years ...	70	72	71

It is very generally believed that ewes mated with a Dorset Horn ram are more prolific than those mated with a Southdown or Shropshire. This opinion is not confirmed by the results shown in Table 2, which show that there is little difference between the Shropshire and Southdown breeds, and in this instance both show to advantage over the Dorset Horn. The results obtained by Mr. Burges with the experimental flocks at "Tipperary" in 1931 are similar to those obtained at Avondale.

At Tipperary Dorset Horn, Shropshire, and Southdown rams were mated with Longwool-Merino crossbred ewes and also with Merino ewes. The ewes were aged and the crossbreds mainly Lincoln-Merino crosses. The ewes were divided into three flocks each containing 67 crossbreds and 26 Merinos for mating respectively with Dorset Horn, Shropshire, and Southdown rams, two rams to each flock of 93 ewes. Between mating and the commencement of lambing 10 ewes died, and as it was impossible to determine to which of the flocks any of these belonged, it was assumed that three from each flock had died, thus reducing the number of ewes to 90 in each. The results may be seen from the table hereunder:—

Breed of Ram.	No. of Lambs from—		Total.	Percentage.
	Crossbred. Ewes.	Merino Ewes.		
Shropshire	51	23	74	82
Southdown	54	18	72	80
Dorset Horn	51	20	71	79

These for experimental purposes are close enough to be regarded as equal. They rather suggest that any difference in the fertility of the ewes is due largely to the individuality of the ram and/or special conditions at the time of mating.

In both these experiments, each breed of ram was mated separately with the ewes. The same comparative results may not be obtained if rams of the three breeds were mixed and working with the ewes in the same paddock.

WEIGHT OF LAMBS AT BIRTH.

All lambs were weighed within three days of birth; this operation was carried out at intervals of three days throughout the lambing period. Thus the age of any lamb at weighing was not greater than three days, with an average of 1½ days.

TABLE 3.—AVERAGE WEIGHT OF LAMBS AT BIRTH.

Breed of Lamb.	1931.	1932.	1933.	Average 3 years.
Dorset Horn x B. Leicester-Merino ...	11·5	10·9	11·2	11·1
Dorset Horn x Merino	8·7	9·6	...	9·2
Shropshire x B. Leicester-Merino	9·5	10·6	10·2	10·1
Shropshire x Merino	8·5	8·9	...	8·7
Southdown x B. Leicester-Merino	9·1	10·7	10·2	10·0
Southdown x Merino	8·1	9·0	...	8·6

These average results confirm the general opinion that the influence of the longwool strain in the mother is to appreciably increase the size of the lamb at birth. When mated with the Merino ewe, the lambs sired by the Dorset Horn rams were ½lb. heavier than lambs sired by either the Shropshire or Southdown. When mated with the half-bred Longwool ewe the difference in favour of the Dorset Horn was increased to 1lb.

LAMBS FROM MERINO AND LONGWOOL CROSSBRED EWES
BY THE SAME SIRE.
"TIPPERARY," 24th AUGUST, 1931.

Sire—Southdown.
Weights 6th August, 1931: Merino Ewe, 53 lbs.; Crossbred Ewe, 80 lbs.

LAMBS FROM MERINO AND LONGWOOL CROSSBRED EWES
BY THE SAME SIRE.
"TIPPERARY," 24th AUGUST, 1931.

Sire—Shropshire.
Weights 6th August, 1931: Merino Ewe, 58 lbs.; Crossbred Ewe, 77 lbs.

RATE OF MATURITY.

The comparative average rates of maturity of the lambs produced as the result of mating the Dorset Horn, Shropshire, and Southdown rams with both half-bred and Merino ewes in 1932, and with half-bred ewes only in 1933, are shown in the table hereunder. The results for 1931 have been omitted because it was considered that the varying number of lambs dropped in 1931 for the different crosses did not permit of reliable comparisons being made between the respective breeds:—

TABLE 4.

PERIOD OF MATURITY.

Time taken in days to reach 65 lbs. live weight.

Breed of Lambs.	1932.	1933.
	Days.	Days.
Dorset Horn x B. Leicester-Merino	86	84
Dorset Horn x Merino	102	...
Shropshire x B. Leicester-Merino	99	90
Shropshire x Merino	120	...
Southdown x B. Leicester-Merino	99	92
Southdown x Merino	121	...

LAMBS FROM MERINO AND LONGWOOL CROSSBRED EWES BY THE SAME SIRE.

"TIPPERARY," 24th AUGUST, 1931.

Sire—Dorset Horn.

Weights 6th August, 1931: Merino Ewe, 47 lbs.; Crossbred Ewe, 83 lbs.

It will be seen from this table that the average times taken in 1932 for the lambs from half-bred mothers and sired by Dorset Horn, Shropshire, and Southdown rams to reach 65lbs. live weight, were approximately 86, 99, and 98 days respectively, while for 1933 the corresponding figures were 84, 90, and 92 days. These demonstrate the more rapid growth of the Dorset Horn lambs, which come to hand about a week to a fortnight sooner than those sired by the remaining two breeds. These latter are very similar in their rate of maturity.

It will be seen that the effect of mating the same rams with the Merino ewe, as compared with the Border Leicester-Merino ewe, is to lengthen the period of maturity by about three weeks. It is thus evident that the Merino ewe is not as suitable as the half-bred Longwool ewe for the production of early export lambs.

The results of the experiments carried out by Mr. W. G. Burges at "Tipperary" in 1931 provide additional evidence of the value of both the Dorset Horn ram and the Longwool half-bred ewe for lessening the time necessary to produce lambs of marketable weight. When the first seasonal batch of experimental lambs was being selected for marketing at "Tipperary" on 24th August of that year it was found that, of the progeny of Merino ewes mated respectively with Dorset Horn, Shropshire and Southdown rams, only two lambs—and those by Dorset Horn rams—were of marketable size, whereas 76 lambs from Longwool-Merino ewes, including some from each of the three breeds of rams used, were ready and despatched. The numbers of these and the percentage of the total lambs of each breed are as follow:—

"TIPPERARY" LAMBS, 1931.

Ewe.	Ram.	Number ready for Market.	Percentage.
Longwool-Merino	Dorset Horn	37	72·5
Do.	Southdown	21	38·8
Do.	Shropshire	18	35·2
Merino	Dorset Horn	2	10·0
Do.	Southdown	*Nil*	...
	Shropshire		
	Total	78	44·3

The relative development of the progeny of the Merino and Longwool cross bred lamb by the same ram may be readily seen from the illustrations herewith.

The records show that at Avondale, with the lambs dropped from the beginning of May onwards it can be expected that, with suitable grazing conditions available, from one-quarter to one-half will be ready for slaughter by the end of July. This being so makes it possible, under similar conditions as obtained at the Avondale Experiment Farm regarding the provision of early grazing crops for the ewes and lambs, for our earliest lambs to arrive on the British market late in August or the beginning of September. This is an advantage which the geographical position of Western Australia gives to the lamb breeders of this State over those of the Eastern States and New Zealand, and it will enable West Australian lambs to arrive on the British market at a period when it is scantily supplied with fresh lambs. It is obvious that this feature should be exploited as far as it is economically possible.

EFFECT OF THE BIRTH WEIGHT UPON PERIOD OF MATURITY.

The effect of the birth weight upon the period of maturity was investigated. For this purpose the recorded birth weights of lambs were divided into three groups: the first group included lambs with birth weights of 6, 7, and 8 lbs.; the

second lambs with birth weights of 9, 10, and 11 lbs.; and the third those with birth weights of 12 and 13 lbs. The average number of days for the lambs in each group to reach a live weight of 65 lbs. was ascertained. These details are shown in Table 5 hereunder:—

TABLE 5.

EFFECT OF BIRTH WEIGHT ON PERIOD OF MATURITY.

(Calculated to 65lb. lamb.)

Group 1 includes lambs with birth weights of 6, 7, and 8 lbs.
„ 2 „ „ „ 9, 10 and 11 lbs.
„ 3 „ „ „ 12 and 13 lbs.

Sire.	Group No.	No. of Lambs.	No. of days to produce 65lb. Lamb.	Weekly Growth Rate.
1932.				
Dorset Horn	1	1	90	4·51
	2	15	88·5	4·35
	3	9	81	4·52
Shropshire	1	4	114·5	3·48
	2	22	100	3·85
	3	10	92	4·00
Southdown	1	4	118	3·39
	2	20	100	3·85
	3	10	90	4·07
1933.				
Dorset Horn	1	3	104	3·88
	2	17	85·5	4·49
	3	23	80·5	4·60
Shropshire	1	9	94	4·31
	2	38	90·5	4·27
	3	19	80	4·62
Southdown	1	8	112	3·57
	2	46	92	4·17
	3	18	81·5	4·53

It is seen that the heavier the birth weight so is the period required to reach maturity lessened. In this connection the results of an experiment carried out at the Chapman Experiment Farm in 1918* are of special interest. In that experiment two lots of in-lamb Merino ewes were fed respectively 1lb. chaffed hay and ¾lb. oaten grain. It was found that the average weight of the lambs from the ewes which had the grain ration was 1lb. heavier than that of the lambs from the ewes which were fed on the chaffed hay. It would appear then that, when it is necessary to supplement the natural pasture available for the pregnant ewes with some hand feeding, oat grain should form part of the supplementary ration.

With the exception of the Dorset Horn cross in 1933, the greatest number of lambs fall in the middle group, and some idea of the breed effect on the rate of maturity can be obtained by the rate of maturity of the lambs of each cross in this group.

* Bulletin No. 70—" Sheep Feeding Experiments at the Chapman Experiment Farm," Geo. L. Sutton, 1920.

LIVE AND CARCASE WEIGHTS.

The following table shows the losses between the live weight at the farm and the dressed carcase on the hooks of the abattoirs for the crosses under trial:—

TABLE 6.

EFFECT OF BREED ON PERCENTAGE LOSS ON SLAUGHTER.

Breed of Lamb.	1931.					*1932.			*1933.		
	Average Farm Weight.	Average pre-slaughter Weight.	Average Carcase Weight.	Percentage Loss, Farm to Hooks.	Percentage Loss of pre-slaughter Weight.	Average Farm Weight.	Average Carcase Weight.	Percentage Loss, Farm to Hooks.	Average Farm Weight.	Average Carcase Weight.	Percentage Loss, Farm to Hooks.
	lbs.	lbs.	lbs.	%	lbs.	lbs.	lbs.	%	lbs.	lbs.	%
Dorset Horn x B. Leicester-Merino	70·6	64·2	33·5	52·5	47·8	67·1	34·6	48·4	63·5	32·2	49·3
Dorset Horn x Merino	62·6	57·1	28·5	54·5	50·1	66·9	32·7	50·8	...	...	...
Shropshire x B. Leicester-Merino ...	64·7	59·4	32·2	50·2	45·8	63·5	33·0	48 0	60·5	31·8	47·4
Shropshire x Merino	60·4	55·7	28·6	52·6	48·7	62·6	31·8	49·2	...	...	...
Southdown x B. Leicester-Merino...	66·0	60·2	31·2	52·7	48·2	63·6	33·9	46·7	60·9	31·6	48·1
Southdown x Merino	62·5	57·3	31·2	50·1	45·5	63·2	32·7	48 6	...	...	...

* Pre-slaughter weights not taken in 1932 and 1933.

This table shows that there is a greater loss on slaughter with lambs from Merino ewes than from those from the half-bred ewes; the difference is roughly 2 per cent. in favour of the latter.

When lambs from the half-bred ewes are compared, the respective losses, consequent upon the use of the different breeds of rams, are not great enough to be significant, and there is indeed little difference between the breeds in this regard, the Dorset Horn, however, showing the greatest loss.

The percentage drop has already been dealt with in Table 2. As a corollary to this it is interesting to record the percentage of lambs marketed in relation to the number of lambs dropped, though the former may not be due to inherent characteristics of the particular breed, but may be largely influenced by the management, or by adventitious causes not altogether within the control of the breeder, such as losses due to disease or the depredations of foxes or dingoes. The relation between the lambs dropped and marketed is shown in Table 7.

Table 7.

PROPORTION OF LAMBS MARKETED TO LAMBS MARKED.

Breed of Lamb.	No. of Lambs Marked.			Lambs Marketed.					
				1931.		1932.		1933.	
	1931.	1932.	1933.	No.	%	No.	%	No.	%
Dorset Horn x B. Leicester-Merino	18	27	50	18	100	26	96	49	98
Dorset Horn x Merino ...	15	21	...	12	80	20	95	...	...
Shropshire x B. Leicester-Merino	10	43	69	10	100	37	86	67	97
Shropshire x Merino ...	21	24	...	18	86	22	92	...	...
Southdown x B. Leicester-Merino	6	39	74	6	100	36	92	72	97
Southdown x Merino ...	19	22	...	17	89	17	77	...	...

The percentages referred to include those obtained from the Merino ewes, and the general tendency shown by the tables for the year 1931 is that a smaller exportable percentage is obtained from these crosses than when the Border Leicester-Merino ewes are used as mothers. This was due to the slower rate at which the lambs from Merinos mature and, in consequence, their lambs had not reached marketable weight when the last draft was sent to the export works. These results emphasise the superior character of the half-bred ewe as a mother of the export lamb.

QUALITY OF THE CARCASES.

The results of the grading of the carcases for the duration of the experiment are shown in Tables 8 and 9; in Table 8 numbers are given, and in Table 9 the numbers have been reduced to percentages.

TABLE 8.—QUALITY OF CARCASES.

Breed of Lamb.	1931.					1932.					1933.					Total, 1931–33.				
	Grades—					Grades—					Grades—					Grades—				
	1st.	2nd.	3rd.	Rejected.	Total.	1st.	2nd.	3rd.	Rejected.	Total.	1st.	2nd.	3rd.	Rejected.	Total.	1st.	2nd.	3rd.	Rejected.	Total.
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Dorset Horn x B. Leicester Merino ewe	4	10	3	1	18	18	5	2	1	26	16	22	10	1	49	38	37	15	3	93
Dorset Horn x Merino ewe ...	Nil	4	8	Nil	12	12	5	3	Nil	20	...	...	...	...	...	12	9	11	Nil.	32
Shropshire x B. Leicester-Merino ewe	8	2	Nil	Nil	10	26	9	2	Nil	37	51	11	4	1	67	85	22	6	1	114
Shropshire x Merino ewe	6	7	5	Nil	18	13	7	1	1	22	...	...	...	...	..	19	14	6	1	40
Southdown x B. Leicester-Merino ewe	5	1	Nil	Nil	6	29*	6	1	Nil	36	53†	13	6	Nil	72	87†	20	7	Nil	114
Southdown x Merino ewe	12	4	1	Nil	17	8	8	1	Nil	17	...	...	...	...	...	20	12	2	Nil	34
Total	35	28	17	1	81	106	40	10	2	158	120	46	20	2	188	261	114	47	5	427

* 22 marked "Swandown." † 36 marked "Swandown." ‡ 58 marked "Swandown.

TABLE 9.—QUALITY OF CARCASES.

Expressed in Percentages of Lambs Graded.

Breed of Lamb.	1931.				1932.				1933.				Average 1931–33.			
	Grades—				Grades—				Grades—				Grades			
	1st.	2nd.	3rd.	Rejected.	1st.	2nd.	3rd.	Rejected.	1st.	2nd.	3rd.	Rejected.	1st.	2nd.	3rd.	Rejected.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Dorset Horn x B. Leicester Merino ewe	21	58	16	5	69	19	8	4	33	45	20	2	41	40	16	3
Dorset Horn x Merino ewe ...	...	36	64	...	60	25	15	...	...	...	...	...	38	28	34	...
Shropshire x B. Leicester-Merino ewe	80	20	...	...	70	24	6	...	76	16	6	2	75	19	5	1
Shropshire x Merino ewe	33	39	28	...	59	32	4·5	4·5	...	...	...	...	48	35	15	2
Southdown x B. Leicester-Merino ewe	83	17	....	...	*81	17	2	...	†74	18	8	...	‡76	18	6	Nil
Southdown x Merino ewe	71	23	6	...	47	47	6	...	...	...	...	...	59	35	6	Nil

* 58% of total marketed were graded "Swandown." † 50% of total marketed were graded "Swandown." ‡ 51% of total marketed were graded "Swandown."

The main feature of the tables is the decided superiority of the Southdown and Shropshire breeds as producers of first-quality lambs, as compared with the Dorset Horn breed when mated with Border Leicester-Merino half-bred ewes. While the two former appear about equal in this respect, the Southdown in reality shows to advantage, as there is a special demand by the British buyer for lambs of this breed, and, as will be shown later, it was possible in 1932 and 1933 to select choice lines from the first-grade lambs of the Southdown cross and obtain higher rates per lb. for them.

The number of first-grade lambs produced by the Merino ewe is definitely less than the number produced by the half-bred mother. The superiority of the half-bred ewe over the Merino for the production of export lambs is thus again demonstrated. With the Merino ewe as the dam, the Southdown ram produced a greater number of better quality lambs than the Shropshire, and both of these rams a greater number than the Dorset Horn. The grading of the consignment of experimental lambs from "Tipperary," and which have already been referred to in connection with comparative periods of maturity of the respective crosses, also confirm these deductions. The mothers of these lambs were Longwool-Merino crossbreds, principally Lincoln-Merino. The carcases by the different rams were graded as follows:—

QUALITY OF "TIPPERARY" LAMBS, 1931.

Quality.	Mark.	Weight.	Sires.		
			Southdown.	Shropshire.	Dorset Horn.
First	Swan	Under 36	17	...	...
Do.	do.	„ 42	4	...	...
Do.	Cygnet ...	„ 36	...	11	17
Do.	do.	„ 42	...	5	9
Second	Curlew ...	„ 36	...	2	7
Do.	do.	„ 42	...	...	3
Third	... ...	...	...	...	1
	Total ...	...	21	18	37

Though the best quality of the other crosses were classed as first grade, it was very evident that the Southdown lambs were superior because of their greater plumpness, "primeness" or "finish," and uniformity.

PRICES REALISED IN LONDON.

With the exception of the carcases in the "rejected" grade, all the lambs from the first year's experiment were forwarded to London. For the two following years only the first and second-grade lambs were sent away, those classed as third-grade being disposed of locally.

Two shipments were sent the first year, the second of which suffered damage by fire while in transit, and its value was assessed by the underwriters.

Consequent upon the demand at higher rates in Great Britain for special quality lambs of the Down type, it was decided to make a special line of the best lambs of the Southdown ram from the Border Leicester-Merino ewes. To these lambs was given the name "Swandown," a name which was considered appropriate for Down lambs coming from Western Australia, the land of the Black Swan. These lambs were specially marked with a label stamped with a black swan and with the name "Swandown" underneath it. The lambs so marked were very favourably commented upon; this was reflected in the price paid for them, which was always higher than that of any other crosses sold on the same day.

The prices realised for the different shipments are given in Table 10 hereunder. The prices quoted for Canterbury lambs on the day of sale are also given for comparison:—

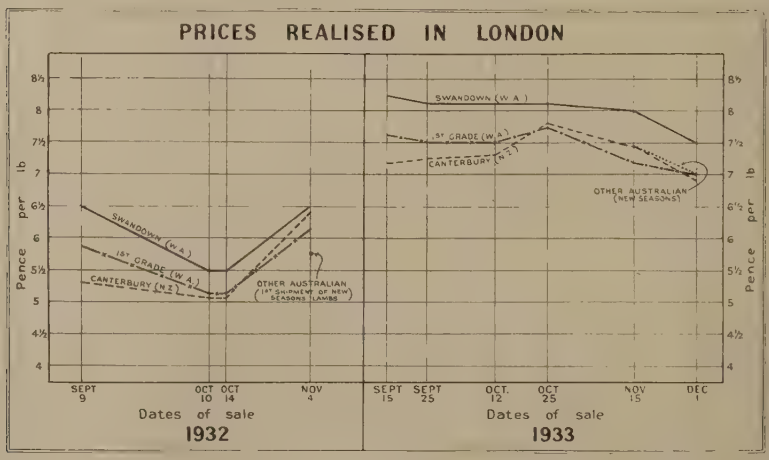
TABLE 10.

PRICES PER LB. REALISED IN LONDON FOR AVONDALE LAMBS.

Shipped per	Date Sold.	Quotations, Canterbury Lambs.	Prices realised, in pence.			
			Swandown.	1st.	2nd.	3rd.
1931.		d.	d.	d.	d.	d.
Deucalion ...	30th October ...	$7\frac{3}{4}$	...	$6\frac{7}{8}$–$7\frac{1}{8}$	$6\frac{1}{2}$	$5\frac{1}{2}$
Cambridge* ...	... ...	...	...	*$7\frac{1}{8}$	...	...
1932.						
Maloja ...	9th September ...	$5\frac{1}{4}$–$5\frac{3}{8}$	$6\frac{1}{8}$	$5\frac{3}{8}$–6	$5\frac{1}{2}$	...
Chitral... ...	10th October ...	5—$5\frac{1}{8}$	$5\frac{1}{2}$	5—$5\frac{1}{4}$	$4\frac{7}{8}$—5	...
Bendigo ...	14th October ...	5—$5\frac{1}{8}$	$5\frac{1}{2}$	5—$5\frac{1}{2}$	$4\frac{3}{4}$—5	...
Cathay ...	4th November ...	6—$6\frac{3}{4}$	$6\frac{3}{4}$	6—$6\frac{1}{4}$	$5\frac{1}{2}$—6	...
1933.						
Mooltan ...	11–15th September ...	$7\frac{1}{8}$–$7\frac{1}{4}$	$8\frac{1}{4}$	$7\frac{1}{2}$ $7\frac{3}{4}$	$7\frac{1}{4}$–$7\frac{1}{2}$	...
Chitral ...	22–25th September ...	$7\frac{1}{2}$	$8\frac{1}{2}$	$7\frac{1}{2}$	$7\frac{1}{4}$	...
Narkunda ...	9–12th October ...	$7\frac{1}{4}$–$7\frac{3}{8}$	$8\frac{1}{2}$ $\frac{1}{4}$	$7\frac{1}{2}$	$7\frac{1}{4}$	...
Strathaird ...	20–25th October ...	$7\frac{3}{4}$–$7\frac{7}{8}$	8—8	$7\frac{3}{4}$	$7\frac{1}{2}$	...
Baradine ...	13–15th November ...	$7\frac{3}{8}$–$7\frac{1}{2}$	8	$7\frac{1}{8}$–$7\frac{1}{4}$	$6\frac{5}{8}$	...
Hobson's Bay...	27th November—1st December	$6\frac{7}{8}$–7	$7\frac{1}{4}$–$7\frac{3}{4}$	7	$6\frac{1}{2}$–$6\frac{5}{8}$	...

* Cargo damaged by fire. Values assessed at rates of previous shipment.

The comparative prices realised for "Swandown" lambs during 1932 and 1933 are shown in graph form, and are compared with the quotations of Canterbury and "other" Australian lambs sold at that time.



It will be seen from this graph that the prices realised for the special line of lambs sired by the Southdown, and marked "Swandown," have been from 3/8d. to 3/4d. per lb. higher than our own first-grade lambs, and have even ranged from 3/8d. to 1 1/4d. per lb. higher than the Canterbury lambs. This is extremely gratifying when the good name of these latter on the London market is borne in mind. It must, however, be pointed out that at the beginning of our season our lambs are "fresh," whereas the New Zealand lambs have been in store for some time. Neverthless, the results obtained have justified the action taken, and demonstrated that lambs of the highest export quality can be produced in Western Australia, if bred in the right way and fed adequately.

The graphs for both years show that the difference in price decreases as the time approaches for the marketing of the New Zealand new season's consignments. It is, therefore, obviously to the benefit of West Australian producers to arrange to market their lambs as early as the climatic conditions will allow, and so take advantage of the fortunate position when the London market is comparatively bare of lambs from our competitors.

SUMMARY.

Experiments were commenced at the Avondale Experiment Farm in 1931, and continued in 1932 and 1933 in order to obtain definite information under West Australian conditions regarding the relative suitability of:—

(1) The Dorset Horn ram;

(2) The Shropshire ram;

(2) The Southdown ram;

when mated with:—

(a) The Longwool half-bred ewe; and

(b) The Merino ewe

for the production of export lambs most suitable for the British market.

The Border Leicester-Merino ewe was used as a type to represent the Longwool half-bred ewe.

The seasonal characteristics are described.

To supplement the natural dry pasture early in the lambing season, fodder crops of oats and rape were grown during the last two years, and ewes, after lambing, were pastured on these.

The experimental flocks mated with each breed of ram consisted of 54 ewes in 1931, 84 in 1932, and 89 in 1933.

Contrary to the popular belief the fecundity of the ewes mated with the Dorset Horn was not greater than that of those mated with the Shropshire or Southdown.

The effect of the Dorset Horn ram was to give a lamb of about 1lb. heavier at birth than the Shropshire and Southdown rams when mated with Border Leicester-Merino ewes, and an increase of 1/2lb. when mated with Merino ewes.

The weight of lamb at birth influences to some extent the period required for maturity: generally, the heavier the lamb at birth the shorter the time required

The lambs of the half-bred ewes matured about three weeks earlier than those from the Merino ewes mated with the same rams.

The lambs sired by the Dorset Horn ram matured 7 to 14 days earlier than the lambs either by the Shropshire or Southdown.

The lambs by these two latter matured about the same time.

The geographical position of Western Australia makes it possible to produce export lambs to arrive on the London market late in August, when that market is scantily supplied with "fresh" lambs.

There is a greater loss on slaughter, approximately 2 per cent., with lambs from the Merino ewes than those from the half-bred ewes.

When rams of the different breeds were mated with half-bred ewes, the differences in the loss on slaughter of the lambs sired respectively by the Dorset Horn, Shropshire, and Southdown, were not great enough to be significant.

THE "SWANDOWN."
Southdown-Border Leicester-Merino, Tipperary, 1931.

The Shropshire and Southdown rams produce a greater number of first-grade lambs than does the Dorset Horn ram.

From the first-grade lambs sired by the Southdown and from the half-bred ewes, it was possible to select a special line of superior quality to which the name Longwool "Swandown" was given.

The number of first-grade lambs produced by the Merino ewe is definitely less than the number produced by the half-bred mother.

The prices realised for first-grade lambs compared favourably with those obtained for New Zealand Canterbury lambs. Those obtained for the special line "Swandown" exceeded the quotations for Canterbury lambs. The difference was greater with the early lambs than with the later ones.

The returns indicate that our lambs should be marketed early; the extent of the earliness, however, must be governed by the ability to provide ample early feed for the ewes in order that the lambs would be able to receive ample nourishment from birth.

The results of these experiments and the price realised, however, definitely show that export lambs of the highest quality, and which are in the greatest demand on the London market, can be produced by standardised methods in the lamb raising districts of this State.

The results of the experiments show that the standard methods for the production of highest grade export lambs are:—

(1) The mating of a Longwool-Merino ewe with a Southdown ram as early as natural conditions will economically permit.

(2) Adequate feeding of the pregnant ewe.

(3) Ample succulent feed for the ewe after lambing provided, if necessary, by supplementing scanty natural feed by the cultivation of fodder crops.

The outstanding features of the results are:—

(1) The predominant value of the Southdown ram for the production of export lambs of the highest quality.

(2) The superiority of the Longwool half-bred ewe over the Merino ewe for the production of fat lambs.

(3) The value of the Dorset Horn ram for mating with the Longwool half-bred ewe when early maturing lambs are specially required, *e.g.*, the local market.

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GRADE HERD RECORDING, WESTERN AUSTRALIA, 1934.

G. K. BARON-HAY, Superintendent of Dairying.

From time to time during the last ten years requests have been made that Grade Herd Recording should be instituted in Western Australia. Although the value of Grade Herd Recording was fully recognised, after careful consideration it was not thought to be in the best interests of dairy farming generally to introduce such a scheme prematurely.

In 1922 it was realised that a very great expansion of the Dairying Industry was imminent in this State, and it was believed that owing to the rapid increase in the area of pasture, every available dairy cow would be required as a potential dam of dairy heifers.

Graph 1 shows that this belief was sound, as the area of pasture increased from 25,337 acres in 1923 to 430,547 acres in 1933. It will be seen from the graph that the number of cows in the State did not increase in the same ratio.

In order to improve the average production of cows in the State, it was decided that a policy of advocating the use of pure-bred dairy sires ex tested dams would attain the desired result, without reducing the effective number of breeding cows in the State, by culling otherwise unprofitable producers. During these years some 700 dairy sires have been purchased and supplied to dairy farmers on easy terms by the Government.

To assist in this aim a Dairy Cattle Improvement Act was passed in 1924, and the results of this policy for mass herd improvement is shown in Graph 2.

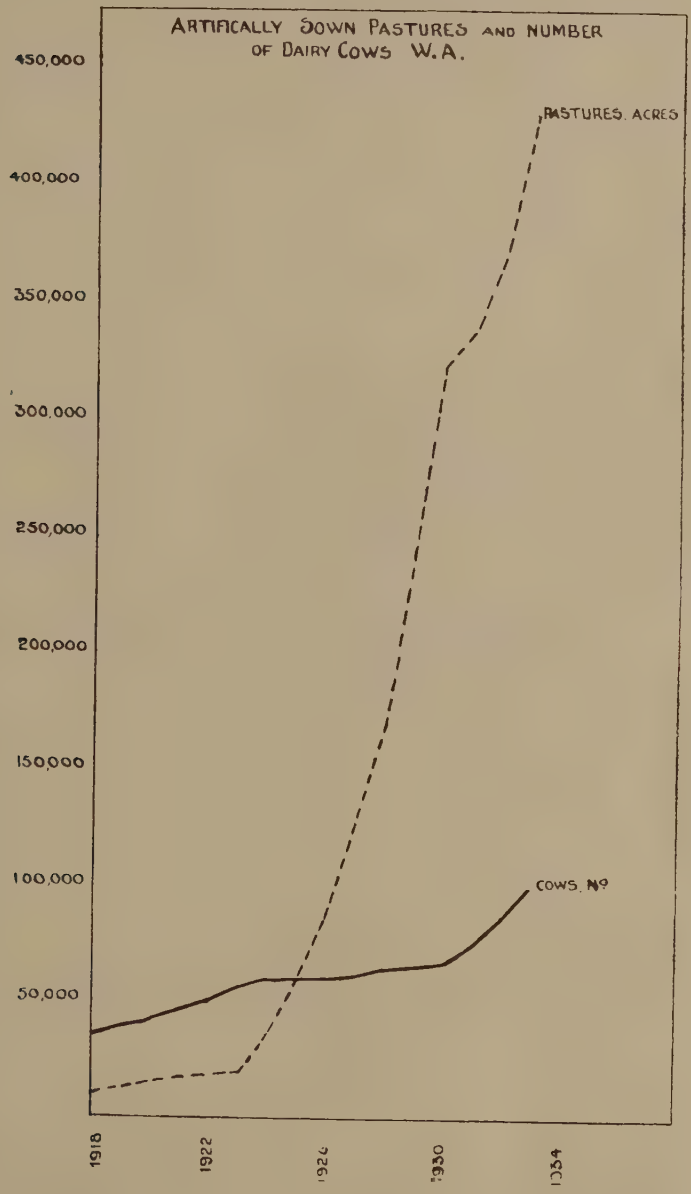
It will be seen that the average production of dairy cows has doubled during the last ten years, coincident with the increase in the use of pure-bred dairy sires, from 23 per cent. to 56 per cent.

During this period of development it was fortunate that the prices of dairy produce remained high (Table 1). However, as soon as these prices commenced to fall, and as dairy farmers had built up the number of their herds during the past ten years, it was believed that the time had arrived when it would be advantageous to institute the recording of grade herds.

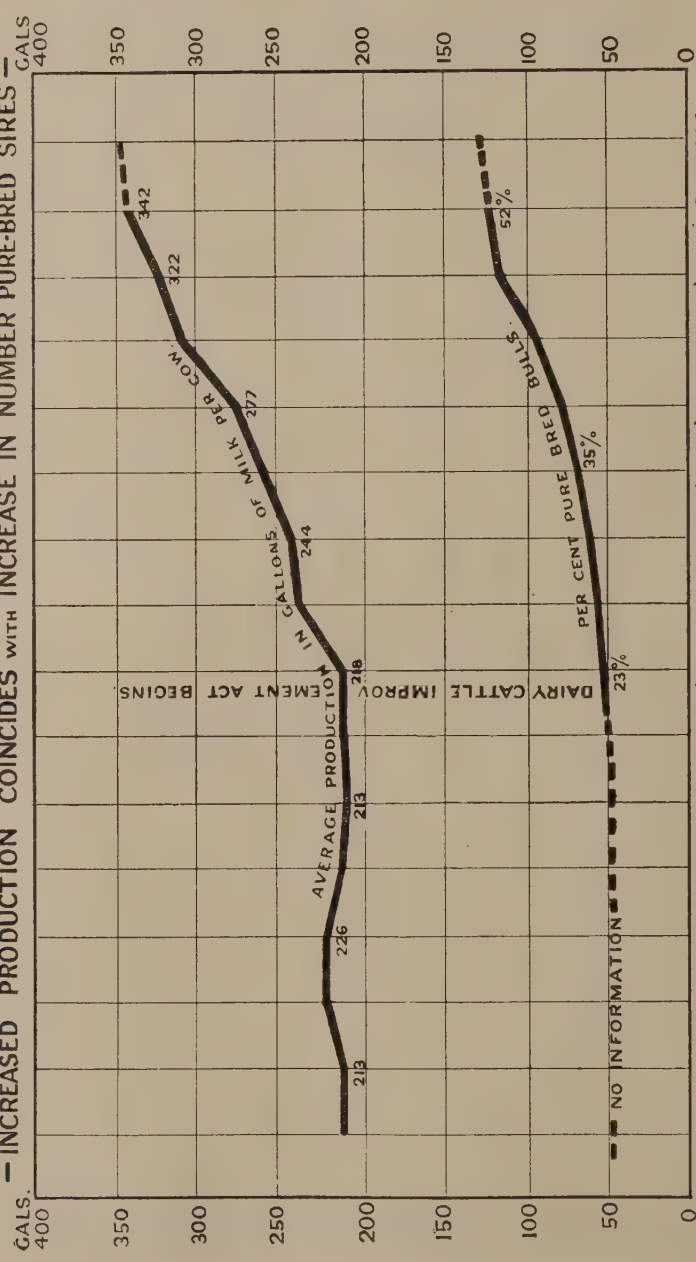
TABLE 1.—PRICE OF BUTTER FAT PER POUND.
1923–1934.

Year.	June.	December.	Average for Year.
	s. d.	s. d.	s. d.
1923	1 9	1 7	1 7¾
1924	1 8	1 3	1 6¼
1925	1 7	1 3	1 5½
1926	1 10	1 7	1 7½
1927	1 8	1 7	1 8
1928	1 8	1 5	1 7⅛
1929	1 9	1 7	1 8⅜
1930	1 7½	1 1½	1 5⅜
1931	1 3	0 11½	1 3
1932	1 0	0 10	1 0⅛
1933	0 10½	0 8	0 9 11/12
1934	1 0	...	...

With the assistance of the Rural Credits Branch of the Commonwealth Bank, and the Western Australian Government, the first grade herd recording unit was commenced at Donnybrook in November, 1932, followed by seven other units in May, 1933.



GRAPH 1.—*Pasture increased from one-third acre per cow to four acres per cow in 10 years.*


— WESTERN AUSTRALIA —
— INCREASED PRODUCTION COINCIDES WITH INCREASE IN NUMBER PURE-BRED SIRES —
GALS.
400
350
300
250
200
150
100
50
0
1918
'19
'20
1921
'22
'23
1924
'25
26
1927
'28
'29
1930
'31
'32
1933
AVERAGE PRODUCTION IN GALLONS OF MILK PER COW
213
226
213
218
244
277
322
342
DAIRY CATTLE IMPROVEMENT ACT BEGINS
PER CENT PURE BRED BULLS
23%
35%
52%
NO INFORMATION

During the year ended 31st May, 1934, 159 herds were submitted for test, comprising 4,038 cows, the production of which is shown in Table 2. The average production of each individual herd in the scheme is shown in Tables 10 to 16 at the end of this article.

Table 2.—*Average Production of Cows.*

Number of Cows.	Milk, gals.	Average Test, %	Butter Fat. lb.
4,038	415	4.35	180.6

These figures include those for all cows which were under test three months or more, and without any allowance for age.

"GRANTHAM" LADY FOWLER III. (3 years).
Owned by J. A. Scars, Donnybrook. 6,231 lbs. Milk 5.4%
Test, 338 lbs. Fat, in 273 days.

The results may be considered encouraging when compared with those in other States where grade herd recording was initiated, and there is no reason why, provided the information is intelligently used, equally as good results should not be obtained in Western Australia in subsequent years of testing.

The figures for Victoria indicate the progress that can be expected.

Table 2.—RESULTS OF GRADE HERD RECORDING IN VICTORIA.

Year.	Number of Cows.	Average Butter Fat Production. lb.
1921	1,600	165
1924–25	7,000	180
1928–29	63,277	222·4
1931–32	89,619	247·3

While the average results during the past year appear encouraging, on examining the productions of cows in each unit, very great differences in yield become apparent, which cannot be attributed solely to the production capacity of the cows. These differences are seen in Table 3.

TABLE 3.—AVERAGE PRODUCTION OF COWS IN EACH UNIT.

Unit.	No. of Herds.	No. of Cows.	Milk.	Test.	Butter Fat.
			lbs.	%	lbs.
A.—Donnybrook	23	446	4,369·00	5·00	219·46
B.—Serpentine	18	372	4,222·50	4·08	172·20
C.—Cookernup	18	509	4,049·51	3·96	160·36
D.—Harvey	20	414	4,190·20	4·45	186·40
E.—Brunswick	21	649	3,810·00	4·44	169·25
F.—Dardanup	21	469	4,088·20	4·61	188·63
G.—Capel	17	814	4,484·98	4·13	182·97
H.—Balingup	21	365	3,862·98	4·52	174·65

It might be inferred that the quality of cows was entirely responsible for the great variation in these average yields, but reports of the Herd Recorders do not substantiate this. A number of factors are known to affect yield, but in every unit it was found that, where herds averaged high yields, it was in great part due to good husbandry practised by the owner in the provision of ample fodder reserves during the summer and early autumn months.

It is significant also that, where whole milk is being sold, it is in these districts generally that yields are low and fodder reserves small. With such a favoured market (butter fat realising 1s. 8d. to 2s. 3½d. per lb.), cows producing low yields of butter fat may be profitable, but in these districts also individual high-producing herds are found. This is exemplified in Table 4, which shows the average production of the three leading herds in each unit and also the average production of the three low-producing herds.

TABLE 4.—PRODUCTION OF THE THREE LEADING HERDS IN EACH UNIT COMPARED WITH THE THREE LOW-PRODUCING HERDS.

Unit.		No. of Cows.	Milk per Cow.	Average Test.	Butter Fat per Cow.
			lbs.	%	lbs.
Donnybrook	1	44	5,964	5·1	306·2
	2	45	3,157	4·77	152·6
Serpentine	1	85	5,591	3·95	221·2
	2	83	3,854	3·66	141
Cookernup	1	53	4,830	4·07	196·5
	2	94	3,583	4·07	146·1
Harvey	1	102	4,572	4·5	206·5
	2	123	2,929	4·16	122
Brunswick	1	83	4,468	4·96	222
	2	89	2,997	4·47	134
Dardanup	1	51	5,189	4·93	256
	2	47	2,730	4·47	122
Capel	1	121	5,645	4·04	228
	2	238	3,203	4·12	132
Balingup	1	58	4,944	4·37	219
	2	60	2,966	4·17	124

1—Average 3 High-Producing Herds ; 2—Average 3 Low-Producing Herds.

It is believed that the Grade Herd Testing movement will be a means of rapidly spreading the principles of good stock husbandry as practised by the owners of the leading herds in each Unit, particularly conservation of fodder and the pro-

vision of succulent fodder during the summer months. To stimulate this spirit of emulation, a number of cups were offered as trophies to be held by the owner of the highest producing cow in each Unit, and the results show that these high producing cows are not the monopoly of any one Unit.

Herd Testing discovers this type of Cow.

Three gallons at calving; 1½ gallons at 2 months; dry at 3 months.

Two and a half tons of good hay per milking cow is necessary as an insurance against scarcity.

DONNYBROOK UNIT.

CUP PRESENTED BY BOYANUP DAIRY COMPANY.

		Milk.	Average Test.	Butter Fat.
		gals.	%	lb.
B. Langridge	"Lucy" AK6, J. ...	938	6·16	577·6

SERPENTINE UNIT.

CUP PRESENTED BY SERPENTINE CO-OP. CHEESE & BUTTER FACTORY, LTD.

		Milk.	Average Test.	Butter Fat.
		gals.	%	lb.
S. F. Russell	"Bishop," Gr. A. ...	880	5·01	442

COOKERNUP UNIT.

CUP PRESENTED BY HON. HOBART TUCKEY, M.L.C.

		Milk.	Average Test.	Butter Fat.
		gals.	%	lb.
L. Winduss	"Tit-Bits," CB 10, A.I.S.	932	4·35	405·4

BRUNSWICK UNIT.

CUP PRESENTED BY BROWNE'S, LTD.

		Milk.	Average Test.	Butter Fat.
		gals.	%	lb.
Flannagan Bros. ...	"Lily," Gr. J.	640	5·84	371

DARDANUP UNIT.

CUP PRESENTED BY HON. LESLIE CRAIG, M.L.C.

		Milk.	Average Test.	Butter Fat.
		gals.	%	lb.
W. Wood	"Judy 1st," FB 11, Gr. J.	772	5·7	442

CAPEL UNIT.

"SUMMERLEA" CUP PRESENTED BY MESSRS. DUNKLEY BROS.

		Milk.	Average Test.	Butter Fat.
		gals.	%	lb.
C. M. Scott	"Champion," Gr. J. ...	772	4·92	381·2

BALINGUP UNIT.

CUP PRESENTED BY MANJIMUP DAIRY PRODUCE COMPANY, LTD.

		Milk.	Average Test.	Butter Fat.
		gals.	%	lb.
S. C. Maidment ...	"Buttercup," Gr. J. ...	849	4·86	413·1

A = Ayrshire ; J = Jersey ; G = Guernsey ; A.I.S. = Australian Illawarra Shorthorn ; R.P. = Red Poll ; Gr. = Grade.

Apart from the educational value of testing, Table 4 indicates that great improvement in average productions of herds may be effected by systematic and intelligent culling. However, before any farmer can commence to cull his herd, it is essential for a number of facts to be known and appreciated, such as the average production of the herd, the individual production of each cow, the allowance to be made for a heifer in comparison with a mature cow, and all other facts regarding feeding. Table 5 below will give some information on these subjects.

1. Boyanup Dairy Coy. Cup—Won by Barton Langridge, Donnybrook.
2. Donated by Hon. Leslie Craig, M.L.C.—Won by W. Wood, Dardanup.
3. Serpentine Falls Cheese Factory Cup—Won by S. F. Russell, Serpentine.
4. Summerlea Cup (Dunkley Bros.)—Won by C. M. Scott, Elgin.
5. Donated by Hon. H. Tuckey, M.L.C.—Won by L. Winduss, Cookernup.
6. Manjimup Dairy Coy. Cup—Won by S. C. Maidment, Balingup.
7. Browne's, Ltd. Cup—Won by Flannagan Bros., Brunswick.

TABLE 5.—HERDS GROUPED ACCORDING TO PRODUCTION.

Herds Tested less than 273 days omitted.

Unit.	No. of Herds.	Pounds of Butter Fat per Herd.				
		300–350.	250–300.	200–250.	150–200.	100–150.
Donnybrook ...	23	2	5	6	9	1
Serpentine	18	...	...	4	12	2
Cookernup	18	...	...	1	11	6
Harvey	18	...	...	1	12	5
Brunswick	21	...	...	4	10	7
Dardanup	17	...	1	5	9	2
Balingup	17	...	...	5	9	3
Capel	21	...	...	5	10	6
Totals	153	2	6	31	82	32
Per cent.	...	1·31	3·93	20·3	53·55	20·91

As would be expected from the different unit averages for production, the distribution of herds in each unit, according to production, varies greatly, as is clearly shown in Table 5.

Small paddocks, permanent pasture and adequate fertilisation necessary for maximum returns on irrigation areas.

It will be seen that the Donnybrook unit embraced the only two herds to exceed 300 lb. butter fat per cow, and this unit has the distinction of containing the three highest producing herds in the Herd Recording Scheme, namely:—

Owner.	Breed.	Number of Cows.	Average Butter Fat. lb.
J. A. Sears	Jersey	8	320·51
H. Noon	do.	20	310·6
A. Trigwell	do.	16	293·7

Dardanup, which is another well established dairying district, was the only other unit to embrace a herd with a higher average production than 250 lb. butter fat per cow. This also was a Jersey herd owned by Mr. C. Richards, whose 15 cows averaged 284.6 lb. butter fat.

Table 5 shows that no less than 21 per cent. of the herds under test averaged less than 150 lb. butter fat, which at ruling rates for butter fat, are definitely unprofitable. Approximately 54 per cent. of the herds tested appear in the 150-200 lb. group, and it is believed that by culling a number of very low producers in this group and by careful attention to feeding, the majority of these herds can be lifted immediately into the 200-250 lb. group which is believed to be profitable.

The influence of feeding and management on production is shown in the following extract from the annual report by the Herd Recorder, Mr. R. A. Paul, at Dardanup.

"The unit could be divided conveniently into farms according to the type of country on which they are situated, namely:—

"1. Clay loam plain country in and around Dardanup, almost entirely devoted to dairying with its adjuncts.

"2. Sandy loam overlying clay on plain country from Crooked Brook to Boyanup.

"3. Hilly country east of Dardanup, farms containing small areas of rich alluvial flats and also hilly grazing land. These farms combined beef production with dairying.

"It is interesting to note that all the leading herds are found on the first type of land. Of the 10 herds, six averaged over 200 lb. butter fat, and one averaged 284 lb. butter fat. The owner, Mr. C. Richards, is to be congratulated on this very fine average.

A cheap means of gathering green material for silage on Mr. T. Flynn's property, Ferguson. A trace chain is used as a loop around each heap of material.

"The standard of stock husbandry is good, feed being provided throughout the year consisting of hay, silage, cow peas, and maize.

"The four cows which yielded over 400 lb. butter fat are also found in this area.

On the second type of land, stock generally were brought into lactation early in May. Where this was not successful, cows *received no particular attention during the summer and, generally, were dried off during January.*

On four of the five farms, no early or summer feed was grown and little hand-feeding carried out.

The five herds, containing 132 cows, averaged 177 lb. butter fat, *though one herd where hand-feeding was practised averaged over 200 lb. butter fat.*

In the third area the averages were lower, probably due to the dual purpose stock out-numbering those of pure dairy type.

The pasture has a short life, *and no early feed was provided for cows and little attention paid to conservation of fodder.*

The six herds, numbering 136 cows, in this area averaged 148 lb. butter fat. *One herd of 32 cows, however, where clover silage, maize, and cow peas were available, averaged 174 lb.*, the majority of the cows only having been tested seven months.

Here again, it will be seen that the conservation of fodder, besides the quality of stock, is the keynote to high production.

It will be seen that, in order to cull intelligently, each farmer must have a definite objective which will vary according to the individual production of his herd. It is quite obvious that the system of culling in herds averaging 150-200 lb.

butter fat would be totally different from that where the average production ranges from 250-300 lb. butter fat. It is essential, therefore, to ascertain where the unprofitable cows are to be found. Are they to be found in the lower producing herds, or are they more or less distributed throughout all herds—both high producing and low?

Silage being drawn to stacks on Mr. T. Flynn's property, Ferguson, by horses and chain-loops.

A further dissection of the information available is shown in Table 6 where individual cows are grouped according to production from 100-500 lb. butter fat per cow.

TABLE 6.—COWS IN EACH UNIT GROUPED ACCORDING TO PRODUCTION.

Cows under Test less than 100 *days not included.*

Unit.	No. of Cows. 500lbs.	Average Butter Fat Production per Cow. Over lbs.	400-500 lbs.	300-400 lbs.	200-300 lbs.	150-200 lbs.	100-50 lbs.	Under 100lbs.
Donnybrook	454	2	9	46	174	134	71	18
Serpentine	372	...	1	10	121	128	83	29
Cookernup	512	...	1	5	84	149	153	120
Harvey	432	...	2	15	132	131	106	46
Brunswick	649	...	...	19	179	182	172	97
Dardanup	391	...	4	29	130	121	91	16
Capel	814	...	...	37	264	207	279	27
Balingup	365	...	1	5	120	126	99	14
Totals	3,989	2	18	166	1,204	1,178	1,054	367
Percentage ...	...	·05	·45	4·15	30·19	29·54	26·42	9·20

The comparative rarity of cows exceeding 300 lb. butter fat, namely, approximately 4½ per cent., is most striking and indicates the great improvement that may

be expected from the use of pure bred sires ex cows which have exceeded the official standard under the Pure Breeds Herd Recording Scheme, namely, 350 lb. butter fat per cow.

As an indication that low producing cows are distributed throughout all herds, it will be seen that the percentage of cows producing less than 150 lb. butter fat (35 per cent.) is considerably greater than that of herds averaging this amount (21 per cent.). This is more clearly indicated in Table 7 where three herds are taken at random and unprofitable cows culled from the herds. In two instances, namely, herds 1 and 3, it will be seen that the productions were reasonably high for the whole herd, but after the percentage of definitely unprofitable or "boarder" cows has been eliminated, the remaining herd is undoubtedly profitable.

Table 7.—EXAMPLES OF "CULLING" TO RAISE AVERAGE PRODUCTION OF THE HERD.

	No. of Cows.	Average Butter Fat per Cow. lbs.	
1.—A Cookernup Herd	31	219	A profitable herd.*
Culled	8	163	Unprofitable cows.
Remainder	23	238	
2.—A Donnybrook Herd	20	174·8	Unprofitable herd.
Culled	5	104·4	"Boarder" cows.
Remainder	15	198·2	Profitable.
3.—A Brunswick Herd	32	195	"Border Line" herd.
Culled	8	136	Unprofitable cows.
Remainder	24	215	Now a profitable herd.

* With butter fat at 1/– per lb., it is assumed that a cow must produce 200lbs. of butter fat to be profitable.

B.F. II. "Darkie," a grade Hereford owned by S. F. Russell, Serpentine. Production 8,737 lbs. Milk, 309.3 lbs. Butter Fat, in 240 days.

Further information regarding the production of cows tested is obtained when the cows are grouped according to age classes. This has been done in Table 8, cows being grouped under the headings of Mature (those exceeding 3 years), 3-year old, Senior 2-year old (over 2½ years at calving), and Junior 2-year old (under 2½ years at calving).

It will be seen that only two cows produced over 500 lb. butter fat—both being owned by Mr. B. Langridge in the Donnybrook Herd Recording Association. "Lucy," a pure-bred Jersey, was the highest producing cow for the year in all Units, producing 577.6 lb. butter fat. The second cow, "Precious," also a pure-bred Jersey, produced 520.1 lb. butter fat in 9 months.

"Lucy," highest producing cow in Donnybrook unit and in Grade Herd Recording Scheme, 1933-34. Owned by Barton Langridge, Donnybrook. Production 938 gallons Milk, 577.6 lbs. Fat, in 273 days. (Photo taken after completing test.)

TABLE 8.—COWS GROUPED ACCORDING TO AGE AND PRODUCTION.

All Cows in Milk less than 100 days are excluded.

Age Class.*	Groups according to Butter Fat Production.							
	Over 500 lbs.	400-500 lbs.	300-400 lbs.	200-300 lbs.	150-200 lbs.	100-150 lbs.	Under 100 lbs.	Total No. of Cows.
Mature	2	16	149	959	737	459	179	2,501
Three years ...	...	2	13	158	237	206	88	704
Senior 2 years old ...	...	...	4	32	71	80	33	220
Junior 2 years old...	...	...	1	65	151	297	89	603
Totals	2	18	167	1,214	1,196	1,042	389	4,028

* Age at commencement of Lactation.

When "culling" it is necessary for farmers to make due allowance for age. For practical purposes for cows under 3 years of age, the production should be multiplied by 1.5 to give a yield comparable with that of the cow when mature. Under 4 years of age, the factor is 1.14, while for cows of 4 years and over, the yield as shown by the Herd Recorder can be accepted.

After making due allowance for age, it is interesting to note the varying percentages of cows in the different age classes which exceed 200 lb. butter fat per cow:—

45 per cent. of mature cows tested exceed 200 lb. butter fat.
61 per cent. of 3-year old cows tested exceed 200 lb. butter fat.
78 per cent. of junior 2-year old cows tested exceed 200 lb. butter fat.

This indicates that the younger cows in herds are of higher production capacity on the average than the older cows, which points to a sound policy of breeding being adopted by farmers generally, as mentioned at the beginning of this article.

"White Rock" Jerseys, owned by Mr. W. S. Partridge, Brunswick. The result of a consistent policy of "grading up" with pure bred bulls over a number of years. This herd of 48 cows averaged 216.5 lbs. of butter fat in 273 days, without allowances for age.

Table 9 shows the percentage of pure-bred bulls in use in each Unit dissected according to breed, the average percentage of pure-bred bulls in use throughout all herds being 69.7 per cent., which is 14.7 per cent. above the average for the State.

In the butter fat producing districts, the Jersey predominates, 36 per cent. of all bulls being of this breed.

In milk producing districts, the Illawarra Shorthorn bull predominates, being 22 per cent. of the total pure-bred bulls.

TABLE 9.—PERCENTAGE PURE BRED BULLS IN EACH UNIT, ACCORDING TO BREED.

Unit.	No. of Herds.	Per cent. P.B. Bulls.	Jersey.	Guernsey.	A.I.S.	Friesian.	Ayrshire.	Red Poll.
Donnybrook ...	23	65·2	56·5	4·34	4·3	...	...	...
Serpentine ...	19	78·9	15·8	...	26·3	21·1	15·8	...
Cookernup ...	23	73·9	4·3	4·34	47·8	13·0	...	4·34
Harvey ...	20	65·0	35·0	...	20·0	5·0	5·0	...
Brunswick ...	21	66·7	42·8	...	23·8	...	...	...
Dardanup ...	21	76·2	57·1	4·76	9·5	...	...	4·76
Capel	17	94·1	35·3	...	47·1	5·9	5·9	...
Balingup ...	21	42·8	42·8	...	...	...	...	...
Total Percentage	165	69·7	36·4	1·8	21·8	5·4	3·0	1·2

It is confidently expected that an average yield of 200 lb. of butter fat per cow can be achieved by the end of the second year's testing period, provided cows that are obviously unprofitable be culled, and that efficient methods of husbandry, embracing particularly adequate fodder conservation, are practised.

Table 10-17 give the average productions of each herd in each Unit, the first three herds only being identified, other herds being represented by a code letter, known only to the owner.

Table 18 gives the names of owners of the three leading herds in each Unit.

TABLE 10.—DONNYBROOK (UNIT "A"). RECORDER P. T. WYLIE.

Owner.	Number of Cows.	Milk—Average per Cow.	Average Test.	Butter Fat—Average per Cow.
		lb.	%	lb.
J. A. Sears	8	5,974	5·3	320·51
H. Noon	20	5,949	5·2	310·60
A. Trigwell	16	5,970	4·8	293·71
Herd "C"	10	5,729	5·0	287·12
" "H"	21	5,167	5·2	273·71
" "G"	17	4,624	5·5	257·22
" "K"	21	4,645	5·5	254·74
" "O"	18	4,486	5·3	237·82
" "N"	10	4,379	5·3	232·52
" "E"	25	4,600	4·9	220·26
" "J"	40	4,534	4·7	216·16
" "L"	14	3,995	5·3	210·80
" "R"	16	4,212	4·8	203·00
" "M"	17	3,879	5·3	199·48
" "D"	26	4,167	4·7	199·02
" "A"	31	4,263	4·9	198·83
" "Q"	20	3,950	4·4	174·82
" "U"	43	4,637	4·7	173·27
" "W"	10	3,665	5·4	165·13
" "F"	24	3,191	5·0	160·91
" "B"	13	3,229	4·8	156·22
" "I"	17	3,177	4·8	155·09
" "P"	15	3,069	4·7	146·80

TABLE 11.—SERPENTINE (UNIT "B"). RECORDER R. POWELL.

Owner.	Number of Cows.	Milk—Average per Cow.	Average Test.	Butter Fat—Average per Cow.
		lb.	%	lb.
S. F. Russell	36	5,631	4·09	230·45
Geo. Bett	22	6,129	3·57	219·02
A. H. G. Heath	27	5,099	4·13	210·63
Herd "Q"	28	5,141	3·95	203·31
" "H"	21	4,012	4·89	196·30
" "G"	17	4,248	4·23	179·93
" "D"	23	3,671	4·75	174·30
" "X"	8	3,818	4·47	170·81
" "B"	27	4,093	4·13	169·08
" "V"	17	4,199	3·91	164·24
" "J"	9	3,890	4·02	156·39
" "P"	38	3,932	3·91	153·65
" "I"	10	3,733	4·06	151·62
" "U"	21	4,122	3·66	151·15
" "T"	52	4,351	3·45	150·20
" "K"	16	3,326	4·47	148·93
" "E"	15	2,692	3·74	100·75
" "W"	15	3,213	4·11	91·05
" "A"	19	2,107	3·71	78·20

"WERRIBEE" STARBRIGHTS KING.

Three times first and champion Perth Royal Show. Also first and champion Bunbury, Bridgetown, Busselton and Donnybrook. A "proved" sire, some of whose daughters are found in Mr. J. A. Sears' herd, the eight cows of which averaged 320.5 lbs. of fat in 273 days.

Pure bred A.I.S. bull "Millions of Maxicar." Seventy per cent. of the bulls owned by members are pure bred, the aim being 100 per cent. pure bred in five years.

TABLE 12.—COOKERNUP (UNIT "C"). RECORDER W. KERR.

Owner.	Number of Cows.	Milk—Average per Cow.	Average Test.	Butter Fat—Average per Cow.
		lb.	%	lb.
O. C. Rath	9	4,654	4·56	212·22
H. D. Hardy	20	5,081	3·77	191·56
J. A. B. Hay	24	4,687	3·98	186·55
Herd "E"	22	4,121	4·37	180·08
.. "B"	25	4,428	3·95	174·89
.. "M"	31	4,316	3·92	169·17
.. "J"	28	5,240	3·22	168·72
.. "D"	20	3,537	4·57	161·63
.. "F"	28	4,106	3·93	161·36
.. "T"	13	4,244	3·78	160·40
.. "U"	18	3,654	4·15	151·65
.. "P"	19	4,164	3·63	151·16
.. "S"	49	3,708	4·00	148·32
.. "A"	23	4,056	3·65	147·24
.. "K"	29	3,369	4·35	146·53
.. "W"	16	3,502	3·85	138·28
.. "O"	26	3,217	3·80	122·74
.. "V"	29	3,259	3·67	119·59
.. "H"	14	2,876	3·96	113·88
.. "X"	17	3,058	3·70	113·15
.. "Y"	12	2,696	4·13	111·36
.. "R"	44	2,833	3·82	108·21
.. "N"	33	2,264	3·97	89·86

"Precious," owned by B. Langridge, Donnybrook. Second highest producing cow tested during the year. 520.11 lbs. butter fat in 273 days; 599.0 lbs. butter fat in 365 days.

"Bishop," highest producing cow in Serpentine unit. Owner S. F. Russell. Production 880 gallons milk, 442 lbs. fat in 273 days.

Table 13.—HARVEY (UNIT "D"). Recorder J. Morgan.

Owner.	Number of Cows.	Milk—Average per Cow.	Average Test.	Butter Fat—Average per Cow.
		lb.	%	lb.
R. Hanks & Son	30	5,169	4·39	243·50
H. M. & C. Gibbs	39	4,191	5·18	195·30
F. Byrd	33	4,479	3·97	185·84
Herd "S"	17	3,872	4·81	185·60
" "N"	24	2,566	4·49	185·08
" "C"	22	3,813	4·60	176·16
" "L"	21	2,397	4·12	176·11
" "M"	24	3,583	4·91	175·97
" "I"	35	3,177	4·45	175·30
" "H"	24	3,581	4·72	169·8
" "D"	15	3,917	4·30	169·17
" "E"	20	3,282	4·36	157·24
" "A"	30	3,330	4·55	151·03
" "R"	15	3,371	3·78	138·18
" "K"	10	2,883	4·73	137·03
" "F"	25	3,075	4·22	132·10
" "G"	58	2,872	4·38	123·90
" "P"	41	2,961	3·96	121·36
" "J"	24	3,013	4·10	119·20
" "V"	33	2,082	4·57	98·53
" "W"	13	716	3·6	25·77*

* One test only.

"Titbits," owned by L. C. Winduss. Cookernup. Production 932 gallons milk, 432 lbs. fat, in 273 days.

The highest producing herd in Harvey unit, owned by R. Hanks & Sons. Thirty cows averaged 243.5 lbs. fat in 273 days.

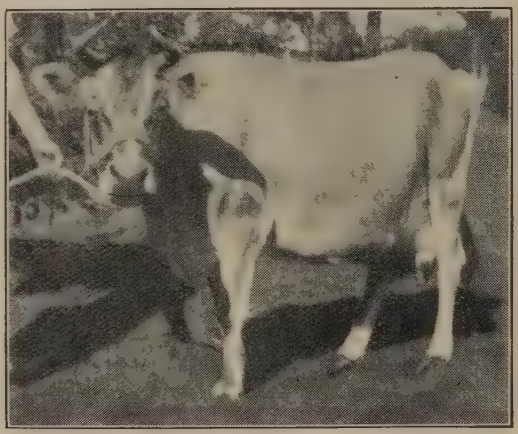
"Lily," highest producing cow in Brunswick unit. Owned by Flannagan Bros., "Riverlands." Production 640 gallons milk, 371 lbs. fat, in 273 days off grass.

Table 14.—BRUNSWICK (UNIT "E"). Recorder A. Hardy.

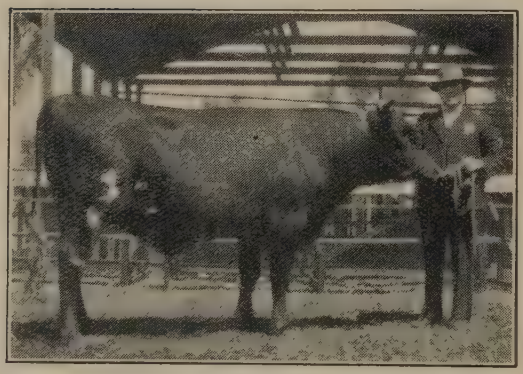
Owner.	Number of Cows.	Milk—Average per Cow.	Average Test.	Butter Fat—Average per Cow.
		lb.	%	lb.
S. Bowers	24	4,879	4·85	236·68
W. Partridge	48	4,169	5·19	216·52
R. Cruickshank	11	4,877	4·39	214·03
Herd "C"	28	4,945	4·29	212·13
„ "I"	45	4,307	4·37	188·42
„ "O"	40	4,730	3·89	184·24
„ "Q"	33	3,823	4·72	180·29
„ "D"	19	3,559	5·01	178·50
„ "H"	23	4,357	3·96	172·76
„ "G"	63	3,622	4·61	167·02
„ "E"	24	3,816	4·22	161·21
„ "Y"	32	3,372	4·67	157·71
„ "U"	33	3,265	4·73	154·55
„ "L"	19	3,398	4·54	154·43
„ "B"	47	3,512	4·13	145·05
„ "R"	17	3,580	4·03	144·46
„ "K"	27	3,574	4·04	144 25
„ "A"	27	3,553	4·02	143·02
„ "J"	24	2,971	4·63	137·59
„ "S"	28	3,342	4·08	136·25
„ "E"	37	2,756	4·70	129 65

Table 15.—DARDANUP (UNIT "F"). Recorder P. Devlin.

Owner.	Number of Cows.	Milk—Average per Cow.	Average Test.	Butter Fat—Average per Cow.
		lb.	%	lb.
C. Richards	15	3,172	5·5	284·60
W. Wood	18	5,190	4·78	248·00
J. Strachan	18	5,203	4·52	235·52
Herd "G"	27	4,667	4·98	232·50
„ "A"	60	4,182	5·19	217·00
„ "H"	32	4,549	4·41	200·60
„ "E"	28	4,372	4·56	199·56
„ "O"	10	4,035	4·54	183·15
„ "J"	20	3,935	4·46	175·70
„ "N"	21	3,879	4·50	174·50
„ "U"	10	3,795	4·60	174·43
„ "K"	32	4,229	4·12	174·10
„ "V"	23	3,581	4·64	166·10
„ "M"	26	3,791	4·05	163·60
„ "R"	13	3,588	4·46	160·10
„ "D"	38	3,400	4·70	158·80
„ "T"	47	3,787	3·93	149·00
„ "P"	3	2,940	5·04	148·30
„ "L"	20	2,883	4·71	135·73
„ "S"	12	3,026	4·20	127·10
„ "Q"	15	2,281	4·52	103·14



"Judy 1st." Production 772 gallons milk, 442 lbs. fat in 273 days. Owned by W. Wood, Dardanup. The "top cow" in the Dardanup unit.



"Summerlea Togo," 1527, Vol. III. Bred by Dunkley Bros., Capel. Sire: Victor of Telyarup, 2498—Dam: Fairy 7th of Newstead. Togo has won six first prizes at Perth Royal, Bunbury and Busselton Shows and has not yet been beaten in his class. He was Reserve South-West Champion at Bunbury and Champion at Busselton, 1933. One of Mr. Dunkley's herds of 41 cows averaged 226.9 lbs. fat in 273 days off grass.

Table 16.—CAPEL (UNIT "G"). Recorder R. Rutherford.

Owner.	Number of Cows.	Milk—Average per Cow. lb.	Average Test. %	Butter Fat—Average per Cow. lb.
T. G. Hutton	28	6,861	3·72	248·91
Summerlea Pastoral Company, No. 1	41	5,493	3·85	226·94
C. A. McCormack	52	4,757	4·64	216·57
Herd "S"	29	5,528	3·83	212·18
" "H"	60	5,088	3·93	203·68
" "D"	36	5,139	3·93	198·11
" "M"	29	4,850	4·07	195·51
" "O"	47	4,279	4·29	181·62
" "I"	107	3,755	4·78	177·54
" "K"	22	4,185	4·25	174·38
" "A"	64	3,779	4·42	169·18
" "E"	38	4,289	3·97	166·69
" "P"	32	3,998	4·03	162·14
" "J"	60	3,451	4·42	161·55
" "C"	48	3,658	4·08	147·06
" "V"	35	3,742	3·78	144·59
" "L"	155	2,942	4·23	123·86

Table 17.—BALINGUP (UNIT "H"). Recorder K. Simes.

Owner.	Number of Cows.	Milk—Average per Cow. lb.	Average Test. %	Butter Fat—Average per Cow. lb.
S. C. Maidment	21	5,233	4·21	220·74
H. Scarr	26	4,965	4·39	218·22
A. S. Wright	11	4,633	4·48	207·73
Herd "J"	25	4,233	4·89	207·28
" "B"	6	3,944	5·20	206·43
" "X"	24	4,365	4·56	199·47
" "W"	12	4,837	4·02	194·45
" "N"	23	4,048	4·74	192·25
" "K"	20	3,747	4·96	186·01
" "C"	26	3,770	4·87	183·66
" "Q"	7	4,060	4·51	183·51
" "O"	11	3,988	4·52	180·64
" "E"	25	3,952	4·43	175·33
" "R"	9	3,833	4·44	170·13
" "U"	24	3,400	4·61	156·91
" "I"	16	3,329	4·34	144·50
" "F"	10	3,100	4·65	144·41
" "P"	28	3,092	4·44	137·43
" "M"	20	3,173	4·03	128·09
" "G"	26	2,703	4·53	122·66
" "A"	14	3,023	4·03	121·99

"Buttercup" produced 849 gallons milk, 413.1 lbs. fat, in 273 days. Owner Mr. S. C. Maidment, Balingup.

TABLE 18.—LEADING THREE HERDS IN EACH UNIT.

Unit.	No. of Cows.	Bull.	Milks.	Test.	Fat.	Owner.
			lbs.	%	lbs.	
A.—Donnybrook	8	P.B.J.	5,974·00	5·30	320·51	J. A. Sears
	20	P.B.J.	5,949·00	5·20	310·60	W. Noon
	16	P.B.J.	5,970·00	4·80	293·71	A. Trigwell
B.—Serpentine...	36	P.B.A.	5,631·00	4·09	230·45	S. F. Russell
	22	P.B.F.	6,129·00	3·57	219·02	G. Bett
	27	...	5,099·00	4·13	210·63	A. H. G. Heath
C.—Cookernup...	9	P.B.G.	4,654·16	4·56	212·22	O. C. Rath
	20	M.S.	5,081·40	3·77	191·56	H. D. Hardy
	24	M.S.	4,687·40	3·98	186·55	J. A. B. Hay
D.—Harvey ...	30	M.S.	5,169·80	4·39	243·50	R. Hanks & Sons
	39	J.	4,190·90	5·18	195·30	H. M. and C. Gibbs
	33	F.	4,479·09	3·97	185·84	F. Byrd
E.—Brunswick...	24	J.	4,879·00	4·85	236·68	S. Bowers
	48	J.	4,169·00	5·19	216·52	W. Partridge
	11	...	4,877·00	4·39	214·03	R Cruikshank
F.—Dardanup ...	15	Grade J. (now P.B.)	5,171·70	5·50	284·60	C. Richards
	18	J.	5,190·25	4·78	248·00	W. Wood
	18	J.	5,203·70	4·52	235·52	J. Strachan
G.—Capel ...	28	F.	6,860·68	3·72	248·91	T. G. Hutton
	41	M.S.	5,943·00	3·85	226·94	Summerlea Pastoral Co. No. 1
	52	J.	4,757·40	4·65	216·57	C. A. McCormack
H.—Balingup ...	21	M.S.	5,233·00	4·21	220·74	S. C. Maidment
	26	...	4,965·00	4·39	218·22	H. Scarr
	13	...	4,633·00	4·48	207·73	A. S. Wright

Includes all cows tested 100 days or more.

A good appetite means high production. Mr. F. Byrd's cow at Harvey.

HERD TESTING.

THE OFFICIAL AUSTRALIAN PURE-BRED DAIRY CATTLE PRODUCTION TESTING SCHEME, 1933-34.

G. K. Baron-Hay (Superintendent of Dairying).

For the year ended 30th June, 1934, 247 pure-bred cows completed their lactation period, the average production being 306.65 lb. butter fat per cow without allowances for age.

The following table shows the average production of butter fat of all cows which completed their lactation period according to each class:—

		Number of cows.	Average Butter Fat. lb.
1.	Mature	66	.. 339.40
2.	Senior 4 years	21	.. 370.76
3.	Junior 4 years	14	.. 291.82
4.	Senior 3 years	27	.. 312.52
5.	Junior 3 years	29	.. 292.85
6.	Senior 2 years	25	.. 285.23
7.	Junior 2 years	65	.. 269.39
	Total	247	.. Av. 306.65

The trophy for the dairy sire with the greatest number of daughters to exceed the official standard during the year was won by the Australian Illawarra Shorthorn bull "Triumph of Pine Creek," owned by the Wooroloo Sanatorium Farm. Fourteen daughters completed the test during the year, the average production being 325.59 lb. butter fat at an average age of 2 years $10\frac{1}{2}$ months. This bull is undoubtedly one of the outstanding dairy sires in the State.

It is instructive to notice that his 17 daughters tested in 21 lactation periods, the average production was 312.3 lb. butter fat at an average age of 2 years 9 months. The dams of these daughters produced an average of 283 lb. butter fat. The daughters, therefore, showed an average improvement of 13.7 per cent. over the dams.

A Fine Team Owned by S. P. Herbert, "Nooka," Nungarin.

Left to right: "Nooka Ragtime Rose," 1 year 11 months, 310 lbs. fat in 273 days; "Nooka Carnation," junior, 3 years, 407 lbs. fat in 273 days, highest production for the age and breed, second all breeds under official Government test in 1932; "Nooka Wild Rose," senior 2 years, 358 lbs. fat in 273 days, first all breeds official Government Test in 1932; "Nooka Lass," senior 2 years old, 330 lbs. fat, senior 3 years old, 370 lbs. fat in 273 days.

HERD TESTING.

THE OFFICIAL AUSTRALIAN PURE BRED DAIRY CATTLE PRODUCTION RECORDING SCHEME.

Conducted by Dairy Branch, Department of Agriculture, Western Australia.

G. K. Baron-Hay, Superintendent of Dairying. Year ending 30th June, 1934.

MATURE COWS (OVER 5 YEARS OLD)—STANDARD 350 LBS. BUTTER FAT.

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Calving.	No. of Days in Test.	Weight of Milk Last day of Test.	Weight of Milk for period.	Average Test.	Butter Fat.	Owner.	Sire.
						lb.	lb.	%	lb.		
Koojan Bonnie Elizabeth ...	Guernsey...	1899	23 3–27	5–5 33	273	24½	9,253	6·2	570·97	A. W. Padbury ...	Robin of Nundorah 417
Kurrawong Kitty 8th	A.I.S. ...	16030	6–8 26	22–5–33	273	30	11,535	4·6	525·92	W. G. Burges ...	Premier of Kurrawong 1212
Nancy 9th of Raleigh	do. ...	17519	30–4 27	23 8–33	273	34	10,722	4·9	525·82	D. Bevan	Union Jack of Raleigh 2375
Sally of The Hill	do. ...	15741	8 10 27	30–7–33	273	28	13,164	3·96	521·82	W. G. Burges ...	Crescent of The Hill 2016
Pansy 5th of The Hill ...	do. ...	15729	2–2–25	30–6 33	273	28·5	12,835	3·95	506·71	W. G. Burges ...	Crescent of The Hill 2016
Grass Vale Lady Fowler 3rd ...	Jersey ...	19111	20–5–25	6–5 33	273	27	9,306	5·50	494·84	R. H. Rose	Rye Duke of Glen Iris
Gold of East View	A.I.S. ...	10940	1 5–26	14–8 33	273	20	14,055	3·47	488·05	W. G. Burges ...	Mariner of Greyleigh
Kathleen 5th of Kurrawong ...	do. ...	16027	13–12 25	31 7–33	273	31	11,978	4·0	480·61	W. G. Burges ...	Premier of Kurrawong 1212
Grass Vale Montrose Maid ...	Jersey ...	24929	18–6 27	6 6–33	273	17·5	9,442	5·07	478·69	R. H. Rose	Montrose East of Glen Iris
Karridale Pride	Guernsey...	1981	16 10 27	26–3–33	273	27	9,306	5·1	477·79	G. E. Scott	Minnamurra Oliver Twist
Limelight's Camelia of Wangara	A.I.S. ...	17879	24 7–27	27–5–33	273	31	10,908	4·2	455·84	W. G. Burges ...	Limelight of Darbalara
Tabbagong Dove 4th	do. ...	14725	30 9–26	22–7–33	273	21	11,493	4·0	453·18	W. G. Burges ...	Mayflower Repeater of Hill View
Claremont Lupin 4th	do. ...	2406	9–5–28	22–7 33	273	30	10,575	4·28	452·70	Hospital for Insane ...	Telyarup Prince
Lady Mint's Gem 7th of Garden Hill	Jersey ...	20876	8–10–25	25–7–33	273	24·5	7,214	6·15	444·15	Robinson Bros. ...	Cream Socks of Glen Iris
Greenmount Bo-Peep	do. ...	20902	24–6 25	6–8–33	273	26·5	8,734	4·9	427·70	A. J. B. Strempel ...	Werribee Starbright's King
Numbawarra Lu Lu	A.I.S. ...	4022	21–9 26	11–5–33	273	31	10,840	4·2	423·03	D. Bevan & Sons ...	Fairy's Foch of Fairfield
Springmead Barbara	Jersey ...	13295	20–2–22	9–2 33	273	31·5	9,228	4·5	417·47	Sabina Vale Stud Farm	Springmead Osram
Wooroloo May 2nd	A.I.S. ...	15145	25–10 26	22 10–32	273	19·5	8,518	4·7	403·07	Wooroloo Sanatorium Farm	Commercial of Blackheath
Nooka Pearl	Jersey ...	28189	2–12–27	6 12 32	273	20	6,930	5·7	400·64	S. P. Herbert ...	Jessie's King of Sarnia
Picture 8th of Raleigh ...	A.I.S. ...	17524	22–4 27	19 3–33	273	35	10,710	3·9	396·82	D. Bevan & Sons ...	Union Jack of Raleigh 2375
Stone Hill Silver Mary ...	Jersey ...	23668	3–6–26	22–6–33	273	14	5,767	6·78	391·11	C. Kreins	Lassie's Chief of Roelands
Carnation of Minathorpe ...	A.I.S. ...	...	6–5–26	3–11 32	273	8	8,724	4·4	387·25	R. Bee & Sons ...	Bruce of Sunnyvale
Greenmount Charming Lass ...	Jersey ...	20903	3–6–25	14–7 33	273	17·5	6,247	6·0	375·83	A. J. B. Strempel ...	Werribee Starbright's King
Denmark Anne	Guernsey...	1164	2–3–25	7 6–33	273	15	7,470	5·02	375·27	Denmark Stud Farm	Linwood of Wollongbar
Wooroloo Red Rose	A.I.S. ...	2521	17–2 28	25–3–33	273	17·5	8,302	4·5	372·29	Wooroloo Sanatorium Farm	Triumph of Pine Creek 2515
Claredon Eyre Betty	Jersey ...	39244	28–4–28	30–5–33	273	22	9,126	4·05	369·78	Sabina Vale Stud Farm	Clarendon Eyre Eminent's Achievement
Pendant of Fast View	A.I.S. ...	18339	18–6–28	5–7–33	273	22·5	11,077	3·3	367·68	A. E. Grant	Sultan of East View
Moorelands Agnes	Jersey ...	23680	11–6 26	6–5 33	273	12·5	6,967	5·2	366·95	P. Rose	Colonel of Melrose
Claremont Biddy 8th	A.I.S. ...	17908	10–8–27	19 1–33	273	18	9,069	4·06	365·49	Claremont Hospital for Insane	Telyarup Prince of Claremont
Muresk Buttercup	Guernsey...	1799	19–4–27	26–4 33	273	21	7,008	5·2	363·99	Muresk Agricultural College	Triumph of Wollongbar 513

Star Fern's Princess of Glen Iris	Jersey ...	14175	18-8-23	1-8-33	273	8	5,814	6·20	361·02	L. Temple	Starbright Prince of Glen Iris
Roslyn 2nd of Raleigh ...	A.I.S. ...	17533	19-10-27	12-3-33	273	25	9,345	3·9	360·99	D. Bevan & Sons ...	Union Jack of Raleigh 2375
Muresk Rose	Guernsey...	2156	9-5-28	4-7-33	273	22	6,591	5·5	360·72	Muresk Agricultural College	Triumph of Wollongbar 513
Stone Hill Golden Bell ...	Jersey ...	30944	25-7-27	15-9-33	273	16	6,498	5·50	357·41	C. Kreins	Lassie's Chief of Roelands
Greenmonnt Charming Bells II.	do. ...	23708	12-3-26	7-8-33	273	19	6,717	5·2	352·78	A. J. B. Strempel ...	Cheerup of Hamel Lea
Newry Lady Betty	Guernsey...	1885	20-5-27	3-7-33	273	19·5	6,673	5·08	339·32	G. E. Scott	Koojan Mack
Grass Vale Fairy Rye	Jersey ...	23689	1-6-25	25-9-33	273	7·5	7,252	4·66	337·93	C. H. Ironmonger ...	Rye Duke of Glen Iris
Wooroloo Alice 2nd	A.I.S. ...	2517	19-4-28	9-5-33	273	10·5	7,518	4·5	336·31	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Greenmount Bonnie Lass ...	Jersey ...	28237	23-3-28	10-6-33	273	13	6,144	5·42	333·18	A. J. B. Strempel ...	Werribee Starbright's King
Moorlands Bemil	do. ...	20885	2-8-25	24-3-33	273	12·5	6,832	4·6	314·87	P. Rose	Colonel of Melrose
Elsie 4th of Raleigh	A.I.S. ...	17481	24-1-27	3-12-32	273	31	8,043	3·8	305·74	D. Bevan & Sons ...	Union Jack of Raleigh
Wollongbar Betty II.	Guernsey...	1571	4-7-26	29-7-33	273	11	5,928	4·9	291·04	Muresk College ...	Bounty of Wollongbar
Karridale Lady Biddy	do. ...	2332	29-5-28	6-8-33	273	14	5,712	5·03	285·01	E. D. P. Hayes ...	Minnamurra Oliver Twist
Ethel 13th of Raleigh	A.I.S. ...	17489	9-9-26	27-10-32	240	14·5	6,570	4·3	282·45	D. Bevan & Sons ...	Barrister of Raleigh
Carnation 2nd of Minathorpe ...	do. ...	17939	18-5-27	23-11-32	210	21	6,570	4·3	281·76	R. Bee & Sons ...	Collier of Darbalara
Melba 48th of Darbalara ...	do. ...	14119	28-1-22	25-2-33	273	23	7,239	3·78	272·62	H. O. Timms ...	Kitchener of Darbalara
Moorland's Anne	Jersey ...	23686	26-5-26	25-6-33	210	9·5	5,205	5·2	271·74	P. Rose	Colonel of Melrose
Diamond 3rd of Raleigh ...	A.I.S. ...	17472	19-11-26	20-12-32	240	22	7,170	3·8	269·91	D. Bevan & Sons ...	Union Jack of Raleigh
Springmead Hinemoa	Jersey ...	13296	6-8-22	23-11-32	273	18·5	6,910	3·9	268·32	Sabina Vale Stud Farm	Springmead Osram 1777
Fairy Rye of Grass Vale ...	do. ...	2368	1-6-25	2-11-32	210	11	5,820	4·5	262·71	C. H. Ironmonger ...	Rye Duke of Glen Iris
Moorlands Blur	do. ...	24918	8-8-27	30-4-33	240	12	5,055	5·1	257·88	P. Rose	Grafter of Melrose.
Koojan Lady Betty 4th ...	Guernsey...	1616	22-5-26	11-2-33	210	20	5,700	4·5	257·79	A. W. Padbury ...	Robin of Nundorah
Spurfield Air Girl 2nd	do. ...	1048	22-4-24	23-10-32	273	12	4,881	5·2	256·92	Muresk College ...	Milton Steadfast
The Flower of Telyarup ...	A.I.S. ...	14747	24-4-22	20-9-32	210	10·5	6,075	4·0	241·00	H. O. Timms ...	Carl of Blackheath
Springmead Lady Osram ...	Jersey ...	18295	2-11-23	11-1-33	273	18	5,709	4·2	240·10	Sabina Vale Stud Farm	Springmead Osram
Tabbagong Dove 5th	A.I.S. ...	4467	3-11-27	6-4-33	180	27	5,565	4·2	238·35	W. G. Burges ...	Daisy's Gift of Hill View
Muresk Carnation	Guernsey...	1800	30-5-27	29-10-32	240	15·5	5,040	4·7	235·53	Muresk College ...	Triumph of Wollongbar
Milkmaid of Blackheath ...	A.I.S. ...	10091	9-7-18	6-10-32	240	9	6,210	3·8	233·79	H. O. Timms ...	Flower's Mayfield of Blackheath
Vanity 8th of Oakdale ...	do. ...	12931	10-12-19	8-1-33	273	16·5	6,259	3·7	228·39	H. O. Timms ...	Standard of Oakdale
Thelma of Blackheath	do. ...	14748	24-9-20	13-11-32	210	12·5	6,000	3·5	214·95	H. O. Timms ...	Flower's Mayfield of Blackheath
Della 11th of Oakdale ...	do. ...	9355	10-7-18	1-11-32	210	12	4,875	...	187·86	H. O. Timms ...	Courage of Oakdale
May of Wooroloo	do. ...	15144	18-8-25	15-5-33	90	28	3,195	...	141·93	Wooroloo Sanitorium Farm	Commercial of Blackheath
Muresk Lily	Guernsey...	1801	16-2-27	4-5-33	120	18	2,370	...	125·67	Muresk College ...	Triumph of Wollongbar
Brookvale Noble Lily	Jersey ...	24894	19-8-26	28-6-33	90	27·5	2,475	...	106·74	G. F. Coombs ...	Noble Lad of Roelands
Daisy of Glenavon	A.I.S. ...	Foundation	1926	13-2-33	90	33	3,075	...	106·44	D. Bevan & Sons ...	(Foundation)

COWS OVER 4½ YEARS AND UNDER 5 YEARS—STANDARD 330 LBS. BUTTER FAT.

Banyule Silvermine 55th ...	Jersey ...	25473	2-8-28	25-5-33	273	34	10,887	6·07	660·55	Sabina Vale Stud Farm	Air Lord of Banyule
Yallah Farm Maggie 2nd ...	A.I.S. ...	1272	30-8-28	17-8-33	273	30	13,140	3·71	503·31	W. G. Burges ...	Fussy's Favo of Parkview
Karridale Lady Betty	Guernsey...	2331	19-9-28	20-7-33	273	25·5	9,166	5·32	488·04	G. E. Scott	Minnamurra Oliver Twist
Karawarra Plum 3rd	A.I.S. ...	1261	27-4-28	24-9-33	273	38	12,474	3·80	474·42	W. G. Burges ...	Sailor of Karawarra
Nooka Carnation	Jersey ...	25218	17-5-28	14-12-32	273	26	8,283	5·8	464·21	S. P. Herbert ...	Jessie's King of Sarnia
Empress 4th of The Hill ...	A.I.S. ...	15703	26-5-28	24-9-33	273	10	11,115	4·10	455·73	W. G. Burges ...	Crescent of The Hill
Springpark Starbright's Queen ...	Jersey ...	24901	16-3-28	19-10-32	273	25	7,590	6·0	455·45	Robinson Bros. ...	Prince Marinora of Grass Vale
Koojan Polly	Guernsey...	2665	13-12-28	30-8-33	273	14·5	7,453	5·23	389·77	A. W. Padbury ...	Koojan Golden Governor
Newry Lady Freda	do. ...	2719	13-9-28	...	273	12	6,446	5·90	379·54	G. E. Scott	Koojan Mack
Denmark Rose Pearl 3rd ...	do. ...	1798	23-11-27	20-10-32	273	19	6,942	5·4	373·77	Denmark Stud Farm	Rose Chief of Wollongbar
Minnamurra Confetti	do. ...	1859	20-7-27	13-9-33	273	21	6,753	5·46	368·62	Muresk College ...	Judge of Wollongbar
Muresk Daisy	do. ...	2155	16-6-28	26-9-33	273	24	7,127	5·09	363·13	Muresk College ...	Triumph of Wollongbar
Muresk Carnation	do. ...	1800	30-5-27	29-9-33	273	16	6,783	4·95	336·13	Muresk College ...	Triumph of Wollongbar

HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Calving.	No. of Days in Test.	Weight of Milk Last day of Test.	Weight of Milk for period.	Average Test.	Butter Fat.	Owner.	Sire.
						lb.	lb.	%	lb.		
COWS OVER 4½ YEARS AND UNDER 5 YEARS—STANDARD 330 LBS. BUTTER FAT—*continued.*											
Moorlands Celia	Jersey ...	28210	15-5-28	30-3-33	273	13	6,429	5·0	321·10	P. Rose	Colonel of Melrose
Moorlands Ceres	do. ...	28211	17-5-28	26-3-33	273	9·5	5,593	5·4	306·29	P. Rose	Colonel of Melrose
Venus 8th of Raleigh	A.I.S. ...	17540	3 2-28	16 10 32	240	15·5	8,370	3·9	323·78	D. Bevan & Sons ...	Royal Standard of Darbalara
Karridale Royal Lady	Guernsey...	2333	10 10-28	7-8 33	273	23	6,579	4·77	313·92	E. D. P. Hayes ...	Minnamurra Oliver Twist
Kurrawong Snowdrop 22nd ...	A.I.S. ...	18229	14-10-28	29-4-33	273	2·5	7,298	4·0	289·89	A. E. Grant	Merry Count of Berry
Muresk Violet	Guernsey...	2157	26-6-28	18-5-33	273	14	5,472	5·1	277·53	Muresk College ...	Triumph of Wollongbar
Springmead Fern	Jersey ...	...	5-3-28	5-12-32	273	10	5,025	4·8	240·77	Sabina Vale Stud Farm	Springmead Islander
COWS OVER 4 YEARS AND UNDER 4½ YEARS—STANDARD 310 LBS. BUTTER FAT.											
Telyarup Duchess	A.I.S. ...	2504	9 12 28	4 3 33	273	42·5	13,792	3·8	522·84	A. E. Grant	Baron of Darbalara
Grass Vale Sweet Maggie 2nd ...	Jersey ...	28229	27 3 29	12-6-33	273	10·5	3,770·5	4·85	357·80	R. H. Rose	Starbright Sweet Duke of Glen Iris
Tipperary Pansy	A.I.S. ...	2442	2-12 28	25-3-33	240	26	7,395	4·5	334·41	A. E. Grant	Villiers of Darbalara
Greenmount Gipsy Lass ...	Jersey ...	28239	6-3-29	27-6-33	273	12	5,271	6·2	324·58	A. J. B. Strempel ...	Werribee Starbright's King
Muresk Primrose	Guernsey...	2527	3-3-29	19 4-33	273	15·5	5,956	5·4	324·10	Muresk College ...	Triumph of Wollongbar
Kurrawong Nancy 3rd	A.I.S. ...	...	9 3-29	29-4-33	273	15	7,320	4·2	311·43	D. Bevan & Son ...	Premier 2nd of Kurrawong
Moorlands Doris	Jersey ...	31235	14 5-29	17-5-53	240	11·5	5,755	5·15	296·98	P. Rose	Melrose Romeo
Denmark Rosa 3rd	Guernsey...	2523	5-4 29	20-6-33	240	6	5,985	4·76	285·18	Denmark Stud Farm	Wollongbar Reformer
Moorlands Dora	Jersey ...	31233	21-5-29	4-6-33	240	8	4,965	5·60	281·67	P. Rose	Melrose Raleigh
Moorlands Carona	do. ...	28223	15-11-28	3-5-33	240	8	4,620	5·6	251·88	P. Rose	Melrose Romeo
Moorlands Duetto	do. ...	31240	22-5-29	15-6-33	273	9	4,272	5·70	243·40	P. Rose	Melrose Raleigh
Tabbagong Society 7th ...	A.I.S. ...	1695	7-1-29	7-2 33	240	10	6,180	3·7	225·12	W. G. Burges ...	Daisy's Gift of Hill View
Moorlands Dot	Jersey ...	31236	16 5-29	6 8-33	210	11·5	4,050	4·98	200·01	P. Rose	Melrose Romeo
Lottie 5th of Kurrawong ...	A.I.S. ...	18225	8-11 28	11-2-33	120	24·5	3,150	...	126·90	W. G. Burges ...	Premier 2nd of Kurrawong
COWS OVER 3½ YEARS AND UNDER 4 YEARS—STANDARD 290 LBS. BUTTER FAT.											
Wooroloo Rose 2nd	A.I.S. ...	2523	27-4 29	1 3-33	273	19	9,042	4·5	417·85	Wooroloo Sanatorium Farm	Triumph of Pine Creek
New Park Amy 7th	do. ...	1865	14 6-29	31 1 33	273	34	10,902	3·7	409·07	W. G. Burges ...	Ruler of Greyleigh (1855)
New Park Sally 9th	do. ...	1873	30 4 29	4-4-33	273	23	10,839	3·9	399·58	W. G. Burges ...	Ruler of Greyleigh (1855)
Tabbagong Topsy 12th ...	do. ...	4472	18-12-29	14-7-33	273	32	10,161	3·8	388·69	A. E. Grant	Regent of Tabbagong
Brookfield's Lady Lillian ...	Guernsey...	2720	28-11-29	3 7 33	273	22·5	7,508	5·06	380·16	G. E. Scott	Koojan Lord Barclay
Moorlands Duchess	Jersey ...	31239	11-7-29	5-5-33	273	13	7,134	5·2	364·11	P. Rose	Melrose Romeo
Burnside Myrtle	Guernsey...	2541	29-10-29	29-7-33	273	23	7,014	5·03	352·70	E. D. P. Hayes ...	Minnamurra Prairie Don
Wooroloo Red Rose II. ...	A.I.S. ...	2522	25-6-29	19-5 33	273	15	7,605	4·5	339·43	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Minnamurra Palm Olive ...	Guernsey	2616	30 8 29	27-4-33	273	17	6,906	4·7	331·09	Muresk College ...	Caramana Favour

Wooroloo Lass	A.I.S. ..	...	30 12-29	26 8-33	273	21	7,668	4·38	330·32	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Melba 3rd of Tipperary ...	do. ...	2358	11 10 29	12 4 33	273	21	7,863	4·0	318·12	R. Bee & Sons ...	Melba's Re-Echo of Tipperary
Spurfield Eastern Jewel ...	Guernsey...	2390	1-12 29	12-7-33	273	23	6,384	5·0	317·32	Muresk College ...	Spurfield Eastern King
Moorlands Dingle	Jersey ...	31281	9-7-29	24-5-33	273	13·5	6,610	4·77	315·79	P. Rose	Melrose Raleigh
Minnamurra Sun Lady ...	Guernsey...	2811	25-2-30	28-8-33	273	20	5,790	5·44	315·03	Muresk College ..	Minnamurra Justice
Wyuna Jean	do. ..	2471	8-9-29	15 5-33	273	16	6,603	4·8	314·02	Muresk College ..	Nundorah Buccaneer
Minnathorpe Treasure V. ...	A.I.S. ...	2477	20–10–29	23-5 33	273	14	6,747	4·5	306·59	R. Bee & Sons ...	Collier of Darbalara
Minnamurra Currency Lass ...	Guernsey...	2606	7–10–29	28–4–33	273	14	6,162	5·0	306·08	Muresk College ...	Caramana Favour
Stone Hill Mary 2nd	Jersey ...	31197	4–10–29	18–9–33	273	13·5	5,110	5·80	296·74	C. Kreins	Grass Vale Carnation's Best
Muresk Petunia	Guernsey	2796	29–11–29	27–9 33	273	19	5,532	5·35	296·29	Muresk College ...	Triumph of Wollongbar
Nooka Wild Rose	Jersey ...	28191	31–12 28	28–12–32	240	17·5	5,955	4·7	284·28	S. P. Herbert ...	Montrose East of Glen Iris
Banyule Silvermine 59th ...	do. ...	29033	10–2–29	28–12 32	273	21	5,973	4·6	274·60	Sabina Vale Stud Farm	Banyule Super Strain
Denmark Red Rose 3rd ...	Guernsey...	2521	6–3–29	13–1–33	273	14	4,467	5·8	261·84	Denmark Stud Farm	Rose Chief of Wollongbar
Rannock Blue Bell	A.I.S. ...	5183	5–2 30	14 8-33	273	12	6,531	3·99	260·90	D. Bevan & Sons ...	Telyarup Count
Wyuna Goldie	Guernsey...	2470	12–10–29	2–6 33	273	12	4,951	5·2	255·53	Muresk College ...	Nundorah Buccaneer
Clarendon Eyre Tangerine 2nd ...	Jersey ...	33952	24–4–29	28–11 32	273	20·5	5,491	4·1	225·65	Sabina Vale Stud Farm	Clarendon Eyre Eminent's Music Master
Glanavon Verna	A.I.S. ...	2369	6–4–29	25–10–32	240	19	5,370	4·1	222·33	D. Bevan & Son ...	Pine Creek Dunbar
Banyule Silvermine 66th ...	Jersey ...	28847	10-9-29	3-6 33	90	31	3,090	...	151 11	Sabina Vale Stud Farm	Milkmaid's Chief of Banyule

COWS OVER 3 YEARS OLD AND UNDER 3½ YEARS—STANDARD 270 Lbs. BUTTER FAT.

Nooka Ragtime Rose	Jersey ...	34743	7 4 30	14 8-33	273	29·5	6,883	5·56	383·00	S. P. Herbert ...	Spring Park Prince Ragtime
Cookalabai Jewel	Guernsey...	3771	18 9 29	19 2-33	273	24	7,497	4·8	362·43	A. W. Padbury ...	Cookalabai Pride 2nd
Colmyn Celiene Rye	Jersey ...	34751	10–8–30	29–9–33	273	16	6,903	5·1	351·66	C. H. Ironmonger ...	Colmyn Captain Mack
Burnside Judy	Guernsey	2540	5–5–29	20–10 32	273	14·5	5,983	5·8	349·04	E. D. P. Hayes ...	Minnamurra Prairie Don
Springhurst Mellot 4th ...	Jersey ...	33648	2–4–30	23 4 33	273	20·5	6,451	5·3	344·61	Sabina Vale Stud Farm	Valiant Prince of Glen Iris
Moorlands Etna	do. ...	34809	20 4 30	27 7 33	240	15·5	6,540	5·2	339·21	P. Rose	Melrose Raleigh
Moorlands Elsie	do. ...	34803	12–6 30	26 5 33	273	10	6,195	5·1	332·86	P. Rose	Melrose Romeo
Widgee Waa Beauty 7th ...	A.I.S. ...	5116	19–4–30	28–9–33	273	20	8,385	3·9	325·89	W. G. Burges ...	Mayflower's Monarch of Parkview
Moorlands Enid	Jersey ...	34805	16–6–30	26–5–33	273	9·5	5,998	5·1	315·56	P. Rose	Melrose Raleigh
Springhurst Belladonna 4th ...	do. ...	33644	12 2-30	13–4 33	273	16·5	6,124	5·1	313·72	Sabina Vale Stud Farm	Starbright's Prince of Glen Iris
Berrington Soprano 2nd ...	do. ...	28851	5–10–29	19 1–33	273	19·5	5,263	5·9	311·66	Sabina Vale Stud Farm	Banyule Super Strain
Springhurst Countess V. ...	do. ...	33647	29–3 30	29 5–33	273	9·5	5,488	5·5	302·42	Sabina Vale Stud Farm	Valiant Prince of Glen Iris
Moorlands Elaine	do. ...	34800	13 4 30	25–6–33	273	10	5,910	5·10	301·32	P. Rose	Melrose Romeo
Wollongbar Rosebud 2nd ...	Guernsey	2789	10–1–30	14 2–33	273	16	6,243	4·9	298·39	Denmark Stud Farm	Wollongbar Satisfaction (960)
Claremont Maggie 3rd	A.I.S. ...	...	30–8 30	8–9–33	240	...	7,245	...	295·65	Hospital for Insane ...	Searchlight of Sunnyvale
Tipperary Priscilla	do. ...	2359	9–9–29	1–3–33	273	23	7,044	4·09	286·41	R. Bee & Sons ...	Villiers of Darbalara
Claremont Biddy 13th	d'. ..	2392	16–12–29	7 3 33	273	22	6,951	4·1	286·31	Hospital for Insane ...	Claremont Evan (447)
Grass Vale Cream Goods ...	Jersey ...	34814	28–8–29	16 10 32	273	13·5	6,340	4·5	282·99	R. H. Rose	Choice Goods of Garden Hill
Moorlands Ethel	do. ...	31808	2–4 30	13 8–33	240	12·5	5,055	5·5	281·70	P. Rose	Melrose Raleigh
Colmyn Nellie Rye	do. ...	34754	8 7 30	20–5 33	273	9·5	5,503	5·10	280·91	C. H. Ironmonger ...	Colmyn Captain Mack
Tipperary Royal Lady	A.I.S. ...	2377	13 11 28	22–10–32	273	9	6,072	4·3	260·56	R. Bee & Sons ...	Melba's Re-Echo of Tipperary
Spurfield Desdemona	Guernsey	2764	29 1–30	2–2 33	273	18	5,004	5·1	257·04	Denmark Stud Farm	Spurfield Eastern King
Wyuna Lady Dawn	do. ...	2472	12–11–29	9 3 33	273	15	4,740	5·3	251·34	Denmark Stud Farm	Nundorah Prosper (664)
Muresk Bluebell	do. ...	3284	17–8–30	25 8–33	273	13	5,274	4·66	246·20	Muresk College ...	Muresk Mineltaus
Denmark Rosa 4th	d'. ...	2794	3–8–29	27 12–32	273	16	5,013	4·8	242·25	Denmark Stud Farm	Wollongbar Reformer
Melba 5th of Minni	A.I.S. ...	5204	12–9 29	15–2–33	210	25	6,210	...	242·24	H. O. Timms ...	Barugh Dairyman
Springburst Sparaxis	Jersey ...	33650	10 3 30	11–7–33	273	10	4,725	5·04	238·29	Sabina Vale Stud Farm	Vigilant of Glen Iris
Moorlands Edith	do ...	34797	11–6 30	24–7–33	240	...	4,662	4·9	220·98	P. Rose	Melrose Raleigh
Wollongbar Haughty	Guernsey	2492	30–11–29	16–2 33	240	11·5	3,535	...	178·35	Denmark Stud Farm	Wollongbar Hopeful

HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Calving.	No. of Days in Test.	Weight of Milk Last day of Test.	Weight of Milk for period.	Average Test.	Butter Fat.	Owner.	Sire.
						lb.	lb.	%	lb.		
COWS OVER 2½ YEARS AND UNDER 3 YEARS—STANDARD 250 LBS. BUTTER FAT.											
Wooroloo Betty II.	A.I.S. ...	..	10 11-30	14-5-33	273	26·5	9,215	4·4	406·47	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Claremont Whitby Maid 11th ..	do. ...	. .	2 6-30	1 5-33	273	36	10,398	3·9	398·38	Claremont Hospital for Insane	Claremont Elector
Nooka Lass	Jersey ...	28187	14-1-29	25-12-32	273	23·5	7,780	4·8	370·75	S. P. Herbert ...	Jessie's King of Sarnia
Claremont Poppy 3rd	A.I.S. ...	...	16-3-30	11-3-33	273	34·5	9,178	4·0	367·05	Claremont Hospital for Insane	Claremont Elector
Staghorn Northlark's Matilda ...	Jersey ...	34787	9-8-30	7 8 33	273	28	6,819	5·25	358·30	Robinson Bros. ...	Staghorn Northlark's Masterpiece
Greenmount Starbright Marinora	do. ...	34841	31-5-30	6 4 33	273	16	6,288	5·67	356·51	A. J. B. Strempel ...	Werribee Starbright's Butter King
Grangelea Pretty Primrose ...	do. ...	33038	31-10 29	23 10 32	273	22	6,171	5·9	354·13	Sabina Vale Stud Farm	Banyule Airo (5751)
Grassvale Butter Queen ...	do. ...	40071	8 7-30	3-6 33	240	15	5,070	6·61	335·67	R. H. Rose	Staghorn Butter's Masterpiece 2nd
Claremont Laura 3rd	A.I.S. ...	8328	26 4 31	4 9 33	273	21	7,893	4·19	331·26	Claremont Hospital for Insane	Claremont Elector
Parkview Tot 2nd	do. ...	4137	30-1-31	21 8-33	273	26·5	7,220	4·16	323·85	W. G. Burges ...	Fussy's Gay Lad of Hillview
Kurrawong Bluebell 10th; ...	do. ...	4245	5 12-30	13 8 33	273	27	7,791	4·15	300·34	D. Bevan & Sons ...	Standard of Cosy Camp
Mokine Miss Fox	Jersey ...	...	24-11-29	11-10-32	273	18	5,589	5·0	277·88	T. H. Wilding ...	Twylish Fox of the Valley
Juadine Juliet 6th	do. ...	34344	20-10-29	10-10-32	273	15	4,680	5·8	272·99	Miss L. Hancock ...	Mokine Repulse
Claremont Cocky 7th	A.I.S. ...	8326	3 1-31	20-9 33	240	14	6,600	3·99	263·42	Hospital for Insane	Searchlight of Sunnyvale
Woodstock Modern Lady ...	Guernsey	3328	27 11 30	26 8 33	273	19	5,577	4·69	261·79	A. G. Haynes ...	Homestead Ace
Muresk Boronia	do. ...	3285	19 8 30	7 5 33	273	12	4,266	6·0	254·07	Muresk College ...	Triumph of Wollongbar
Moorlands Eliss	Jersey ...	34801	19-8-30	22-5-33	240	10·5	4,440	5·49	243·81	P. Rose	Melrose Raleigh
Tipperary Pride	A.I.S. ...	2376	20-2-30	12-11-32	273	22·5	6,187	3·9	239·72	D. Bevan & Sons ...	Melba's Re-Echo of Tipperary
Colmyn Winnie Rye	Jersey ...	34757	5 3-31	21-9 33	273	11	4,578	5·09	233·10	C. H. Ironmonger ...	Rye Duke of Glen Iris
Denmark Rose Pearl 5th ...	Guernsey	3281	20-8 30	2-3 33	273	15	4,245	5·4	229·90	Denmark Stud Farm	Reformer of Wollongbar (538)
Mokine Empire Twylish ...	Jersey ...	...	30-12-29	13-10-32	273	13	4,569	5·1	226·02	T. H. Wilding ...	Twylish Fox of the Valley
Mokine Columbine 6th	do. ...	...	15-2-30	19-10-32	273	18	4,734	4·7	223·81	T. H. Wilding ...	Twylish Fox of the Valley
Colmyn Veronica Rye ...	do. ...	31194	10-11-29	17-9-32	240	9	3,780	...	197·67	C. H. Ironmonger ...	Rye Duke of Glen Iris
Grass Vale Xmas Eve ...	do. ...	34813	24 12 30	14 10 33	120	17·5	2,940	5·40	160·11	R. H. Rose	Campanules Duke of Burekup
Springmead Island Flower ...	do. ...	...	5 5 30	10 1 33	273	6·5	3,154	4·6	143·68	Sabina Vale Stud Farm	Springmead Islander
COWS UNDER 2½ YEARS—STANDARD 230 LBS. BUTTER FAT.											
Nooka May Queen	Jersey ...	41283	3 5-31	24-9-33	273	22	7,888	5·22	412·12	S. P. Herbert ...	Springpark Prince Ragtime
Koojan Bo-Peep	Guernsey	3542	26-2 31	18 4-33	273	23	6,759	5·77	390·15	A. W. Padbury ...	Homestead Ace
Wooroloo Wing Wing 2nd ...	A.I.S. ...	...	2-5-31	7-8-33	273	30·5	8,596	4·35	373·64	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Parkview Violet 12th	do. ...	...	3-5-31	24-9-33	273	32	9,351	3·92	366·63	W. G. Burges ...	Regent of Tabbagong
Parkview Polly II.	do. ...	4133	24-2-31	30-7-33	273	23	9,219	4 00	363·96	W. G. Burges ...	Jean's Monarch of Blacklands
Nooka Rosebud	Jersey ...	...	7 9-31	2-10 33	273	22	6,996	5·20	363·68	S. P. Herbert ...	Springpark Prince Ragtime
Widgee Waa Rosy 5th ...	A.I.S. ...	5117	20-4-30	18 10 32	273	34	9,252	3·8	359·21	W. G. Burges ...	Mayflower's Monarch of Parkview
Claremont Cleggett 4th ...	A.I.S. ...	...	24-11-30	13 4-33	273	29	8,472	4·0	340·59	Hospital for Insane ...	Searchlight of Sunnyvale
Denmark Rose Pearl 6th ...	Guernsey	3282	18-12 31	19 9-33	273	20	6,285	5·16	324·68	Denmark Stud Farm	Wollongbar Reformer
Wooroloo Red Rose 3rd ...	A.I.S. ...	5226	27-9 30	2-2-33	273	18·5	6,325	4·92	310·92	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Claremont Beanie 4th	do. ...	...	11 8 30	21 10-32	273	16	7,088	4·4	305·36	Hospital for Insane ...	Searchlight of Sunnyvale
Travalgan Lady Mint	Jersey ...	...	21-7-30	19-12-32	273	24	5,517	5·5	303·66	Robinson Bros. ...	Fern's Masterpiece of Garden Hill
Parkview Lady May 23rd ...	A.I.S. ...	...	1 6 31	19 9 33	273	21	8,103	3·74	303·07	W. G. Burges ...	Daphne's Defiance of Hillview

Glanavon Penelope	A.I.S. ...	2366	21-8-30	24-11-32	273	29	7,287	4·1	301·58	D. Bevan & Sons ..	Villiers of Darbalara
Wooroloo Sunshine	do. ...	5227	13-2-31	30-7-33	273	17	6,306	4·8	301·50	Wooroloo Sanatorium	Triumph of Pine Creek
Wooroloo Margaret	do. ...	5223	7-10-30	25-3-33	273	18	6,830	4·4	300·82	Wooroloo Sanatorium	Triumph of Pine Creek
Koojan Dairymaid	Guernsey	3543	13-2-31	22-2-33	273	8·5	4,810	6·2	299·64	A. W. Padbury	Homestead Ace
Parkview Poppy 3rd	A.I.S. ...	4135	20-9-30	20-1-33	273	21	7,338	4·0	293·94	W. G. Burges ...	Mayflower's Repeater of Hillview
Tabbagong Fairy 8th	do. ...	7514	14-7-31	21-8-33	273	17	7,011	4·14	290·20	W. G. Burges ...	Parkview Renard 2nd
Moorlands Fizzy	Jersey ...	41100	1-7-31	27-5-33	273	10	5,445	5·20	287·26	P. Rose	Melrose Raleigh
Sabina Vale Lotus	do. ...	...	16-1-32	15-10-33	273	18·5	5,155	5·51	284·46	Sabina Vale Stud Farm	Banyule Airo
Denmark Irish Lass	Guernsey	3269	30-8-30	12-12-32	273	18	5,544	5·1	280·52	Denmark Stud Farm...	Denmark Empire Chief
Wooroloo Bloomer	A.I.S. ...	5218	5-10-30	11-2-33	273	18	6,399	4·4	280·19	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Grass Vale Cream Duchess 5th	Jersey ...	...	4-4-31	9-4-33	273	17	5,676	4·9	276·11	R. H. Rose	Campaniles Duke of Burekup
Mokine Amy	do. ...	...	5-9-30	4-10-32	273	19	5,622	4·8	270·62	T. H. Wilding ...	Mokine Repulse
Wooroloo Jean	A.I.S. ...	5221	15-7-30	9-11-32	273	15	6,405	4·2	269·95	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Nooka Daisy	Jersey ...	...	27-3-31	7-11-32	273	14·5	4,993	5·3	266·53	S. P. Herbert ...	Spring Park Prince Ragtime
Wooroloo Kitty	A.I.S. ...	...	28-4-31	7-8-33	273	16	6,153	4·3	264·64	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Greenmount Little Gem ...	Jersey ...	34839	9-6-31	24-3-33	273	13·5	4,870	5·4	264·01	A. J. B. Strempel ...	Grantham Easter King
Moorlands Florrie	Jersey ...	...	10-6-31	23-3-33	273	12·5	5,152	5·1	258·47	P. Rose	Melrose Sultan
Parkview Model	A.I.S. ...	...	20-10-30	28-11-32	273	23	6,614	3·9	255·79	W. G. Burges ...	Joan's Monarch of Blacklands
Burnside Ladybird	Guernsey...	3322	8-10-30	4-11-32	273	14	5,352	4·7	255·62	E. D. P. Hayes ...	Denmark Radiant Chief
Springmead Lady Rose ...	Jersey ...	...	26-7-30	14-12-32	273	24	5,802	4·4	255·51	Sabina Vale Stud Farm	Springmead Beaucaire (6315)
Moorland's Flower	do. ...	...	13-6-31	8-5-33	273	7	4,461	5·7	254·12	P. Rose	Melrose Clarion
Moorland's Fiona	do. ...	...	16-9-31	18-5-33	273	10·5	4,860	5·2	252·94	P. Rose	Melrose Sultan
Nooka Violet	do. ...	...	18-2-32	12-8-33	273	13·5	4,300	5·85	251·45	S. P. Herbert ...	Springpark Prince Ragtime
Colwyn Nellie Rye	do. ...	34754	8-7-30	8-10-32	273	9·5	5,498	4·6	251·09	C. H. Ironmonger ...	Colwyn Captain Mack
Wooroloo Lily	A.I.S. ...	7741	2-6-31	28-7-33	273	14	5,397	4·6	250·09	Claremont Hospital for Insane	Triumph of Pine Creek
Nooka May Queen	Jersey ...	41283	3-5-31	4-11-32	273	16·5	5,044	5·0	250·42	S. P. Herbert ...	Springpark Prince Ragtime
Colwyn Monica	do. ...	39325	25-9-31	4-9-33	273	9	4,737	5·27	249·67	C. H. Ironmonger ...	Colwyn Captain Mack
Denmark Rosa 5th	Guernsey	3279	18-4-31	5-9-33	273	15	4,755	5·21	248·01	E. D. P. Hayes ...	Wollongbar Reformer
Burnside Myra Bell	do.	3323	13-3-31	22-7-33	273	18	5,334	4·62	246·87	E. D. P. Hayes ...	Denmark Radiant Chief
Greenmount Bonnie Maid ...	Jersey ...	34835	15-5-31	10-3-33	273	10	4,365	5·6	246·85	A. J. B. Strempel ...	Grantham Starbright's King
Moorlands Flo	do. ...	41102	20-8-31	31-5-33	273	11·5	4,804	5·1	245·06	P. Rose	Melrose Clarion
Widgee Waa Beauty 7th ...	A.I.S. ...	5116	19-4-30	14-10-32	273	13	6,099	4·0	244·96	W. G. Burges ...	Mayflower's Monarch of Parkview
Longridge Gentle	do. ...	5016	6-1-31	10-5-33	273	16	5,838	4·2	241·71	R. Bee & Sons ...	Minathorpe Kitchener
Moorlands Fanny	Jersey ...	41097	7-6-31	1-6-33	273	9	4,527	5·30	241·48	P. Rose	Melrose Raleigh
Wooroloo Duchess	A.I.S. ...	...	4-4-31	8-8-33	273	16	5,013	4·78	239·66	Wooroloo Sanatorium Farm	Triumph of Pine Creek
Colwyn Rye Rose	Jersey ...	...	15-10-30	29-12-32	273	18	4,846	4·9	238·79	C. H. Ironmonger ...	Rye Duke of Glen Iris
Parkview Favourite	A.I.S. ...	4127	6-4-31	27-10-32	273	21	6,093	3·9	238·74	W. G. Burges ...	Daphne's Defiance of Hillview
Tabbagong Beauty 18th ...	do. ...	7501	7-8-31	12-8-33	273	17	5,706	4·12	235·02	W. G. Burges ...	Parkview Reward 2nd
Greenmount Gentle Lass ...	Jersey ...	34838	9-8-31	17-4-33	273	10	4,275	5·5	234·63	A. J. B. Strempel ...	Grantham Starbright's King
Radyr Park Clarion	do. ...	...	5-7-31	14-5-33	240	12	3,990	5·87	234·35	L. Temple	Melrose Clarion
Denmark Rose Dame 2nd ...	Guernsey	3280	18-7-31	30-10-32	273	15	4,975	4·7	233·90	Denmark Stud Farm	Wollongbar Reformer
Greenmount Marinette ...	Jersey ...	34840	24-5-31	25-3-33	273	13	4,614	5·0	231·18	A. J. B. Strempel ...	Grantham Starbright's King
Greenmount Easter Pride ...	do. ...	34837	5-5-31	...	273	8·5	4,015	5·8	231·06	A. J. B. Strempel ...	Grantham Easter King
Moorlands Fuschu	do. ...	41106	30-6-31	25-5-33	273	9·5	4,498	5·07	228·35	P. Rose	Melrose Raleigh
Colwyn Lady Rye	do. ...	34753	13-8-30	10-10-32	273	11	4,153	5·1	227·55	C. H. Ironmonger ...	Rye Duke of Glen Iris
Muresk Poppy	Guernsey	3293	8-8-30	8-11-32	273	14·5	3,808	5·9	224·58	Muresk College ...	Triumph of Wollongbar
Burnside Princess	do. ...	3324	1-8-30	25-10-32	273	17	4,806	4·5	216·91	E. D. P. Hayes ...	Denmark Radiant Chief
Travalgan Ice Cream	Jersey ...	...	6-2-31	27-12-32	273	13·5	3,820	5·5	210·67	Robinson Bros. ...	Banyule Altitude
Mokine Sapphire	do. ...	...	30-9-30	20-10-32	273	17	4,461	4·7	210·07	T. H. Wilding ...	Mokine Repulse
Cruntock Cream Lass	Guernsey	...	7-6-31	17-9-33	273	11	3,483	5·92	206·82	Dr. Burnside	
Claremont Lupin 7th	A.I.S. ...	5107	16-1-31	28-12-32	240	18	4,515	4·07	183·24	D. Bevan & Sons ...	Claremont Forrester (448)
Colwyn Show Girl	Jersey ...	34756	28-11-30	16-12-32	273	14	4,047	4·3	174·35	C. H. Ironmonger ...	Colwyn Captain Mack

BANYULE SILVERMINE 55th.

10,887 lbs. milk, 6.07 per cent. test, 660.55 lbs. butter fat in 273 days as senior 4-year-old.

ROSE II. OF WOOROLOO, 2523.

Sire: Triumph of Pine Creek—Dam: Rose of Waterside. At 2 years 5 months of age. Top cow in Senior 3-year old class, 1933-34, 9,042 lbs. Milk, 4.6% Test, 417.85 lbs. Fat.

CHART SHOWING PRICE OF BUTTER-FAT WHEN WHOLESALE PRICE OF BUTTER AND CHARGE FOR MANUFACTURE AND SALE ARE KNOWN.

Wholesale Factory Price of Butter.	Factory Charge for Manufacture and Sale and Price of Butter Fat per pound.												
	5d.	4¾d.	4½d.	4¼d.	4d.	3¾d.	3½d.	3¼d.	3d.	2¾d.	2½d.	2¼d.	2d.
1/9	19·2	19·5	19·8	20·1	20·4	20·7	21·0	21·3	21·6	21·9	22·2	22·5	22·8
1/8¾	18·9	19·2	19·5	19·8	20·1	20·4	20·7	21·0	21·3	21·6	21·9	22·2	22·5
1/8½	18·6	18·9	19·2	19·5	19·8	20·1	20·4	20·7	21·0	21·3	21·6	21·9	22·2
1/8¼	18·3	18·6	18·9	19·2	19·5	19·8	20·1	20·4	20·7	21·0	21·3	21·6	21·9
1/8	18·0	18·3	18·6	18·9	19·2	19·5	19·8	20·1	20·4	20·7	21·0	21·3	21·6
1/7¾	17·7	18·0	18·3	18·6	18·9	19·2	19·5	19·8	20·1	20·4	20·7	21·0	21·3
1/7½	17·4	17·7	18·0	18·3	18·6	18·9	19·2	19·5	19·8	20·1	20·4	20·7	21·0
1/7¼	17·1	17·4	17·7	18·0	18·3	18·6	18·9	19·2	19·5	19·8	20·1	20·4	20·7
1/7	16·8	17·1	17·4	17·7	18·0	18·3	18·6	18·9	19·2	19·5	19·8	20·1	20·4
1/6¾	16·5	16·8	17·1	17·4	17·7	18·0	18·3	18·6	18·9	19·2	19·5	19·8	20·1
1/6½	16·2	16·5	16·8	17·1	17·4	17·7	18·0	18·3	18·6	18·9	19·2	19·5	19·8
1/6¼	15·9	16·2	16·5	16·8	17·1	17·4	17·7	18·0	18·3	18·6	18·9	19·2	19·5
1/6	15·6	15·9	16·2	16·5	16·8	17·1	17·4	17·7	18·0	18·3	18·6	18·9	19·2
1/5¾	15·3	15·6	15·9	16·2	16·5	16·8	17·1	17·4	17·7	18·0	18·3	18·6	18·9
1/5½	15·0	15·3	15·6	15·9	16·2	16·5	16·8	17·1	17·4	17·7	18·0	18·3	18·6
1/5¼	14·7	15·0	15·3	15·6	15·9	16·2	16·5	16·8	17·1	17·4	17·7	18·0	18·3
1/5	14·4	14·7	15·0	15·3	15·6	15·9	16·2	16·5	16·8	17·1	17·4	17·7	18·0
1/4¾	14·1	14·4	14·7	15·0	15·3	15·6	15·9	16·2	16·5	16·8	17·1	17·4	17·7
1/4½	13·8	14·1	14·4	14·7	15·0	15·3	15·6	15·9	16·2	16·5	16·8	17·1	17·4
1/4¼	13·5	13·8	14·1	14·4	14·7	15·0	15·3	15·6	15·9	16·2	16·5	16·8	17·1
1/4	13·2	13·5	13·8	14·1	14·4	14·7	15·0	15·3	15·6	15·9	16·2	16·5	16·8
1/3¾	12·9	13·2	13·5	13·8	14·1	14·4	14·7	15·0	15·3	15·6	15·9	16·2	16·5
1/3½	12·6	12·9	13·2	13·5	13·8	14·1	14·4	14·7	15·0	15·3	15·6	15·9	16·2
1/3¼	12·3	12·6	12·9	13·2	13·5	13·8	14·1	14·4	14·7	15·0	15·3	15·6	15·9
1/3	12·0	12·3	12·6	12·9	13·2	13·5	13·8	14·1	14·4	14·7	15·0	15·3	15·6
1/2¾	11·7	12·0	12·3	12·6	12·9	13·2	13·5	13·8	14·1	14·4	14·7	15·0	15·3
1/2½	11·4	11·7	12·0	12·3	12·6	12·9	13·2	13·5	13·8	14·1	14·4	14·7	15·0
1/2¼	11·1	11·4	11·7	12·0	12·3	12·6	12·9	13·2	13·5	13·8	14·1	14·4	14·7
1/2	10·8	11·1	11·4	11·7	12·0	12·3	12·6	12·9	13·2	13·5	13·8	14·1	14·4
1/1¾	10·5	10·8	11·1	11·4	11·7	12·0	12·3	12·6	12·9	13·2	13·5	13·8	14·1
1/1½	10·2	10·5	10·8	11·1	11·4	11·7	12·0	12·3	12·6	12·9	13·2	13·5	13·8
1/1¼	9·9	10·2	10·5	10·8	11·1	11·4	11·7	12·0	12·3	12·6	12·9	13·2	13·5
1/1	9·6	9·9	10·2	10·5	10·8	11·1	11·4	11·7	12·0	12·3	12·6	12·9	13·2
1/0¾	9·3	9·6	9·9	10·2	10·5	10·8	11·1	11·4	11·7	12·0	12·3	12·6	12·9
1/0½	9·0	9·3	9·6	9·9	10·2	10·5	10·8	11·1	11·4	11·7	12·0	12·3	12·6
1/0¼	8·7	9·0	9·3	9·6	9·9	10·2	10·5	10·8	11·1	11·4	11·7	12·0	12·3
1/—	8·4	8·7	9·0	9·3	9·6	9·9	10·2	10·5	10·8	11·1	11·4	11·7	12·0
11¾	8·1	8·4	8·7	9·0	9·3	9·6	9·9	10·2	10·5	10·8	11·1	11·4	11·7
11½	7·8	8·1	8·4	8·7	9·0	9·3	9·6	9·9	10·2	10·5	10·8	11·1	11·4
11¼	7·5	7·8	8·1	8·4	8·7	9·0	9·3	9·6	9·9	10·2	10·5	10·8	11·1
11	7·2	7·5	7·8	8·1	8·4	8·7	9·0	9·3	9·6	9·9	10·2	10·5	10·8
10¾	6·9	7·2	7·5	7·8	8·1	8·4	8·7	9·0	9·3	9·6	9·9	10·2	10·5
10½	6·6	6·9	7·2	7·5	7·8	8·1	8·4	8·7	9·0	9·3	9·6	9·9	10·2
10¼	6·3	6·6	6·9	7·2	7·5	7·8	8·1	8·4	8·7	9·0	9·3	9·6	9·9
10	6·0	6·3	6·6	6·9	7·2	7·5	7·8	8·1	8·4	8·7	9·0	9·3	9·6

If an equalisation levy is charged, this sum should be deducted from the above price for butter fat to arrive at the net price the farmer will receive.

JOURNAL OF AGRICULTURE.

Erratum.

Page 225, of "Journal of Agriculture," No. 2, Vol. 11, June, 1934. "Further Field Experiments with Manganese as a Control of Grey Speck Disease in Western Australia."

In Table 2, the figures given for Manganese (Mn) for Samples 1 and 2, as calculated from results supplied by the Government Analyst, should read .0220 and not .0078.

THE REDUCTION OF ORCHARDING COSTS.

By H. TARLTON PHILLIPS, B.Sc., Eulomo, Balingup.

In consequence of the reduced price of apples, both at home and abroad, and the diminished margin between expenses and returns, it is impossible to consider the immediate future of the apple-growing industry without some feeling of apprehension.

Since the prices of apples are primarily governed by the general condition of the world's trade, it seems evident that there can be no marked recovery until it becomes possible for international trade to once more flow freely through its normal channels, and it is equally evident that a considerable time must elapse before this can be brought about. The grower of apples may therefore look forward to a more or less prolonged period of low prices, and, since he cannot do anything to raise the price of his product, will necessarily have to discover some means of reducing his working costs, if he wishes to survive.

When fruit prices were high, a few pence, more or less, per case, were not of great moment, but where the profits are of the order of 1/- per case, an extra sixpence means an increase of 50 per cent., and may make all the difference between success and failure. The time has therefore come when each grower must carefully review each item of his expenditure, in order to see whether some saving can be made.

What can be done will necessarily depend upon the conditions existing in each particular orchard, but it may be of interest to consider a few general principles, which are applicable to all. Apple-growing costs may be divided into two categories:—

1. Transport and marketing costs.
2. Costs on the orchard.

TRANSPORT AND MARKETING COSTS.

Although there is still scope for the opening up of new markets, for a more scientific distribution of fruit, and for a general reduction in the cost of transport and marketing, such questions cannot be handled by the individual grower, and therefore need not be considered here.

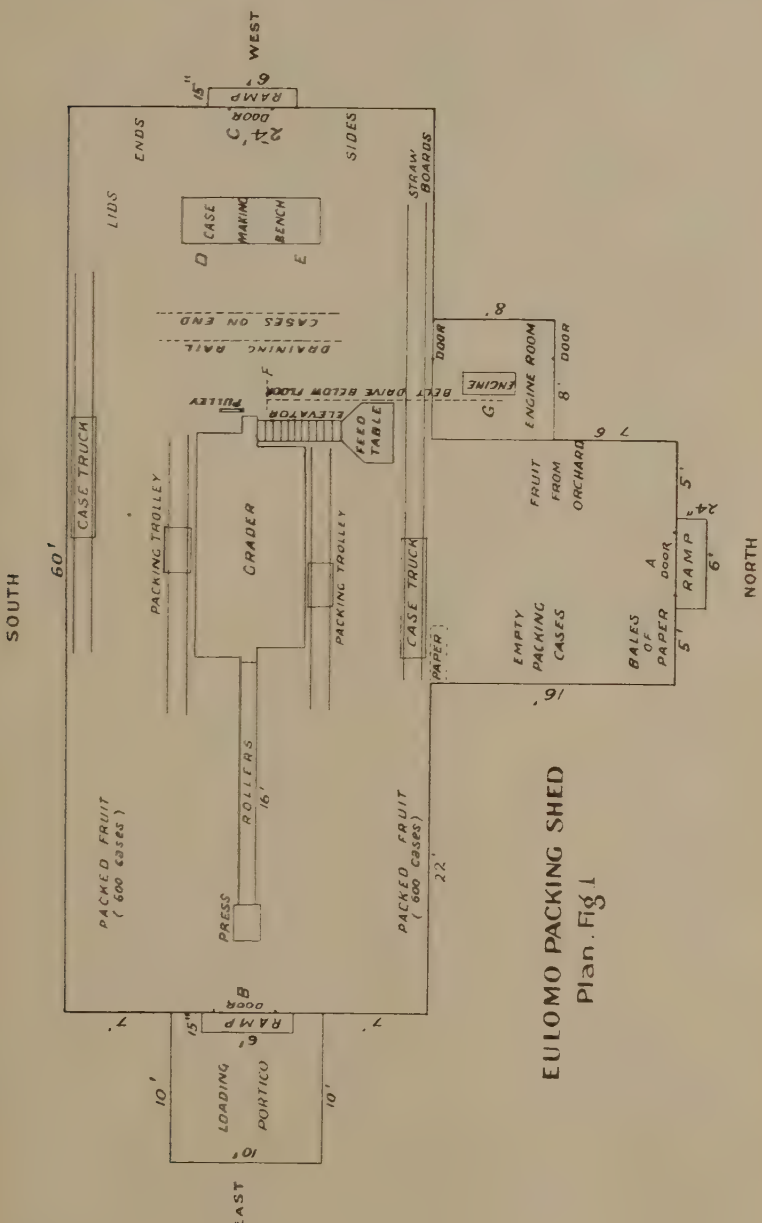
COSTS ON THE ORCHARD.

These costs can very largely be controlled by the orchardist, and may be conveniently considered under two headings:—

(a) Production costs.
(b) Packing costs.

PRODUCTION COSTS.

It will be at once noted that costs, grouped under headings (a) and (b) are entirely different in character. The total cost of production, or growing, is rather of a nature of an overhead expense, being dependent almost entirely on the *area* under fruit, and bearing little or no relationship to the total amount of fruit produced from that area. The cost of picking and packing is, on the other hand, almost entirely independent of the area, being governed almost entirely by the number of cases produced.



EULOMO PACKING SHED
Plan. Fig 1

Now there are only two possible ways in which production costs can be reduced—

1. By an actual reduction in expenditure on the given area.
2. By an increase in the yield per acre, and a consequent reduction in the cost of production per case.

In most cases, costs under heading 1 have been reduced to a minimum, compatible with efficiency, and any further reduction would be followed by a corresponding diminution in yield. In fact, in some cases, an increase in the expenditure on fertiliser, sprays, etc., would be more than repaid by the greater quantity of fruit produced.

As far as costs 2 are concerned, there is probably room for improvement on most orchards. One of the chief considerations, if a high yield is to be obtained, is that each tree in the orchard shall do its share. This is far more important than the obtaining of enormous yields from certain trees or varieties. In the older orchards especially, there are many "duds," which, on account of the variety or the quality of the tree, return little profit. Such trees should be at once eliminated and replaced with better varieties, either by grafting or re-planting.

In the younger orchards this is less noticeable, and the aim should be to secure complete uniformity, as regards both the size and symmetry of the trees, in order to obtain an equal uniformity in both the yield and quality of the fruit, and thus to reduce costs to a minimum. Only by such means, can the maximum yield be obtained.

In many orchards, a considerable amount of extra cultivation might be given, with very beneficial effects, as regards the yield and quality of the fruit. On the smaller orchards, where most of the work is done by the owner, the increase in out-of-pocket expense would be negligible. In this connection, it should not be forgotten that the function of summer cultivation is not merely to conserve moisture, but, by keeping the soil aerated, to promote bacterial growth, stimulate the release of plant foods from the soil compounds, and greatly increase the fertility of the land.

A comparatively small increase in the total yield will enormously reduce the production cost *per case*, and, taken in conjunction with the savings that may be made in other directions, will go a long way towards putting the orchard on a paying basis.

COSTS ARISING FROM THE MARKETING OF SECOND GRADE FRUIT.

There is another cost, which, although it cannot actually be classed as a production cost, is an important factor in the cost of fruitgrowing, namely, costs arising from the marketing of second grade and under-sized fruit.

The marketing of these grades of fruit has always been a source of loss to orchardists. With the tightening up of the export regulations, and the consequent increase in the amount of this class of fruit available for local disposal, it has become a serious menace to the fruitgrowing industry. In conjunction with the exclusion of certain varieties from export, and the reduced purchasing power of the public, it has given rise to a local price level which, if it continue, must inevitably bring about the elimination of a number of orchardists.

Although a certain amount of attention has been devoted to this question, it does not appear to be generally recognised that the marketing of second grade and

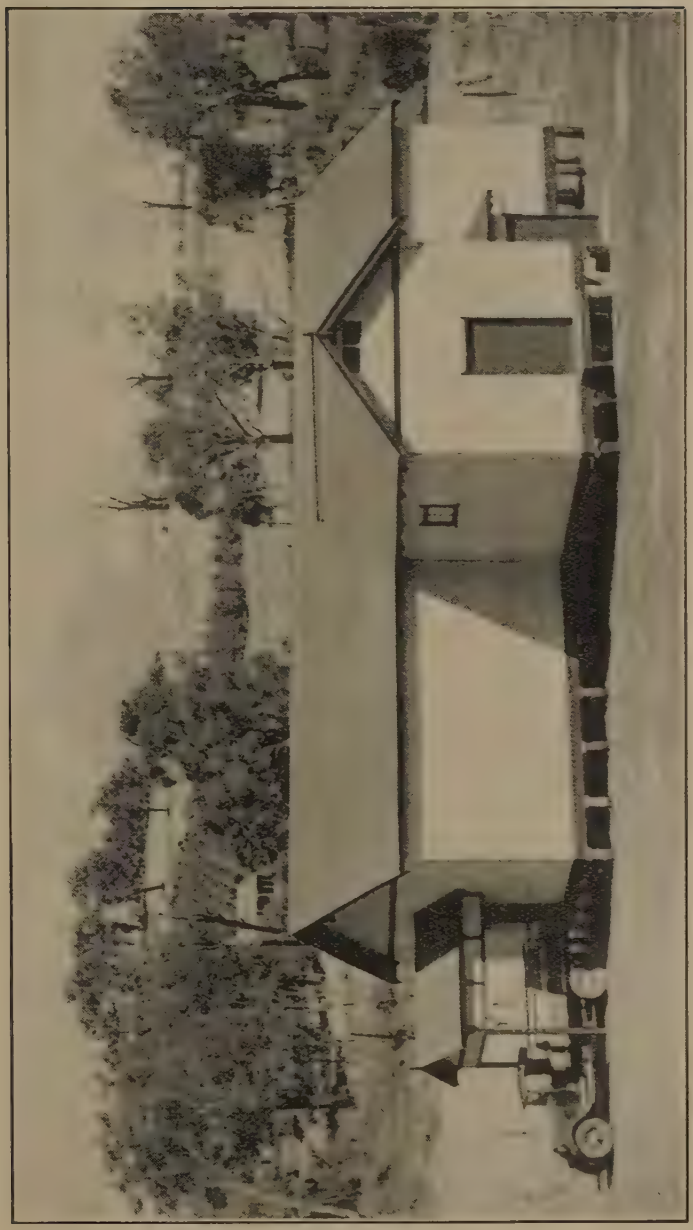


Fig. 2. Eidsvold Packing Shed (North elevation).

under-sized fruit gives rise to what is possibly the heaviest of all individual costs—costs which are quite unnecessary—and to which may be largely attributed the unprofitable state of the industry, as far as the local market is concerned.

Consider the case of a man, who has 1000 cases for sale locally, of which 200 cases are good second grade, or under-sized fruit. There are few instances under present marketing conditions in which the returns for the latter will be sufficient to cover the cost of case, picking and packing, transport and marketing. In fact, more often than not, the net result will be a debit of perhaps 1s. per case after all these items have been taken into consideration.

If these apples had been fed to pigs or cows, if available, they would have given some return, say, sixpence a case; and if they, and all similar fruit, had been kept off the market, the average price level would have been lifted to the extent of at least 2/- per case.

The net result, therefore, of marketing the 200 cases of second grade fruit would be somewhat as follows:—

Net loss of 1/- per case, 200 c/s	£10	0	0
Loss of stock feed 6d. per c/s	5	0	0
Loss of 2/- per case on 800 c/s	80	0	0
	£95	0	0

The above figures are, of course, purely guess-work, but suffice to show the magnitude of the losses, consequent on the marketing of fruit of this class.

This loss is *partially* under the control of each orchardist, and *completely* under his control collectively. It remains for him to decide whether he will remove this disability, or allow himself to drift into bankruptcy.

PACKING COSTS.

It is in the packing and handling of fruit in the shed that there is most scope for economy on the average orchard.

Most packing sheds are made from old stables, or other buildings, which have been more or less adapted to that purpose, and are, in consequence, highly inefficient and quite unsuited to modern conditions.

The packing of fruit consists of a large number of small operations, which are repeated an indefinite number of times, and in which, to secure economy, it is necessary for a most careful examination to be made of each, since the saving of a few seconds here and there will have most far reaching effects on costs. For example, if 160 cases a day are being put through, a saving of one minute a case means a saving of 16 hours a week, which may in some instances reduce the labour which is employed by one hand. These considerations are of particular importance, in connection with the making of cases and their handling, whether full or empty. In the shed to be described, it was found possible, by a suitable re-arrangement of nails, case-parts, etc., to increase the speed of making 25 per cent., and to maintain a regular output of 30 cases per hour. It must be emphasised that this is not so much the result of quick work, as a reduction to a minimum of the distances over which case parts and cases are moved, and the elimination of all unnecessary motions.

These principles, which are well known in connection with mass production in factories, if applied to fruit packing, together with an exact synchronisation of the various phases of the process, produce most startling results, and effect savings which will in most cases pay for the cost of a new shed in a few years.

An attempt to put the above ideas into practice was made by the writer, in a shed of his own design, which was erected last season. As a result of the more convenient location of the shed and of facilities for the unloading and handling of the fruit, it was found possible to handle double the quantity with the same staff and considerably less labour.

The general arrangement of the shed will be seen from the ground plan, Fig. 1, and from the photographs, showing the north and south elevations respectively, Figs. 2 and 3. It will be noted that the shed is built in the form of a T, the principal dimensions being shown on the plan. The walls are made of asbestos sheeting, 12 feet in height, with a seven-foot gable, joints being sealed with asbestos battens. The roof is of iron, painted red, and the wood-work dark green.

The floor, which is of dressed jarrah, oiled with a mixture of equal parts kerosene and sump oil, is raised 2ft. 10in. above the ground at sliding door B, (exit for packed fruit), and door C (entrance for shooks), and 2ft. 2in. at sliding door A, where fruit enters. This brings the floor at the exact level of a lorry at doors B and C, and about 10in. below the level of a cart floor at A, thus facilitating the unloading of fruit, and the loading of empty cases. A portico, placed on the sheltered side of the building, protects the packed fruit from rain, during loading, and the unloading ramp A is built separately from the shed, and distant 4in. from it, in order that the jar of a cart, backed against it, may not be transmitted to the building.

The foundation posts are of split jarrah, placed at 4ft. centres, roughly squared with the broad axe, and measuring 8in. x 8in. at the bottom and 5in. x 5in. at the top, thus reducing the size of the metal ant caps, without impairing their strength, the portions in the ground being well tarred before insertion and the outside posts being oiled, where they are exposed to the weather.

In view of the very heavy loads which the floor of a packing shed is called upon to withstand, special care is necessary in the design of the floor. Shooks stacked to a height of 7 feet, if green, give rise to a pressure of about 500lbs. per square foot, while packed cases, stacked to a height of 7 feet produce a pressure of about 189lbs. per square foot. In order to make provision for these loads, the first 15 feet of the shed, from the West end, where the shooks are stacked, is provided with 8in. x 2in. bearers, 6in. x 2in. being used over the remaining portion of the shed. The floor joists are, in all cases, 4in. x 2in. placed 18in. apart, the floor boards being 6in. x 1in. dressed jarrah. Calculation shows these sizes to allow an ample factor of safety, together with absolute rigidity and freedom from vibration.

As will be seen from Fig. 1, the shooks enter at the west end of the shed, through the door C, sides, ends and lids being stacked as shown, within easy reach of the case making table. This table measures 3ft. x 9ft. by 2ft. 5in. high and carries slots for two case-makers at D and E. It stands on four legs of 6in. x 6in. jarrah, each pair of legs being connected crosswise by a piece of 8in. x 2in. jarrah, checked in $\frac{1}{2}$in. and bolted to them. The decking consists of three pieces of 12in. x 3in. jarrah, running longways, to the top of which is bolted a similar number of 12in. x 2in. jarrah, carrying slots to support the case ends, $\frac{3}{4}$in. bolts, with the heads countersunk below the surface of the bench, being used. Two holes are bored through the bench from the bottom of each slot, to allow sawdust to escape, and the slots are arranged in such a way that a 6in. x 6in. pair of legs comes midway between, providing an absolute solid foundation for case nailing. The case-maker, who also attends to the grader, lidding up, stencilling, stacking, etc., stands at D or E facing the door C and arranges his cases, end up, behind him. Behind this is a movable rail, on which labels are hung to drain, after being

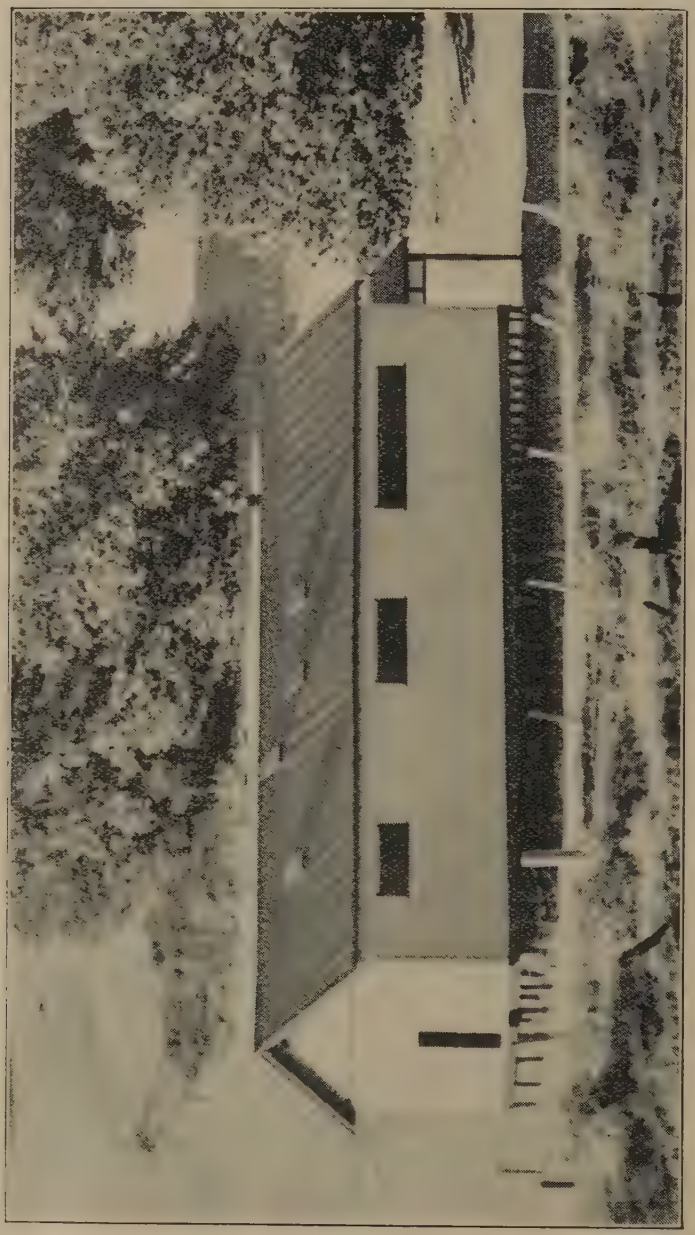


Fig. 3.—Eulomo Packing Shed. (South elevation.)

wetted. After hanging the required number of wet labels on the rail, he covers the ends of the cases with paste, and attaches them. The labelled cases are then transferred to the two case trucks Figs. 1 and 4, which run on lines, as close as possible to the walls, and which have been drawn up opposite to the line of labelled cases. The trucks are then pushed down to a position opposite to the packers. Each truck carries 24 empty cases, and on the top shelf supplies of strawboards and various sized wrapping paper are placed. The trucks are thus at all times within easy reach of the packers, a considerable saving of time resulting, as a result of the eliminating of walking to get cases or paper. The construction of the trucks, will be seen from Fig. 4, the inside dimensions being 1ft. 9½in. wide x 40in. high x 7ft. 11in. long. They run on similar wheels and axles to those supplied for packing trucks.

Fig. 4.—Case Truck.

In the centre of the shed stands a Lightning Grader, Model 21. This is fed by means of an elevator and feed table, the latter having a semi-automatic feed. The capacity of the machine is about a case a minute, the actual amount being dependent on the variety of apple and the speed at which the elevator is run. This may be stopped, or the speed varied instantly, by means of a suitable gear, without stopping the engine or altering the speed of the driving pulley, which is at all times kept constant. The speed of the grading belt may also be altered in a similar manner to suit the different varieties of apples. The grader is driven by a 24 h.p. Wolseley engine, located in an engine room, with a concrete floor, and situated on the ground level. The belt from this drives a countershaft F, beneath the floor of the shed, and from thence, a belt passes upward, through two small holes in the floor, to the grader pulley. The countershaft is carried on posts, which are entirely separate from the building, and there is consequently a complete absence of vibration.

The installation of the above arrangement may be a matter of some difficulty. If a theodolite is available, a line should be laid out, outside the buiding, and parallel with the centre line of the main shed. The ends of this line should be marked by pegs driven into the ground level with the surface, in order to obviate the risk of their being moved. A similar peg should be put in this line, opposite the position of the edge of the engine pulley. Using this line as a datum line it will then be a simple matter to set out the position of the engine block, countershaft, and grader. In some cases, it will be found advantageous, instead of putting the engine direct on to the concrete block in the usual way, to bolt a sawn block of jarrah 4 inches thick to the engine bed, by means of hold-down bolts. The engine may then be attached to this by means of coach screws in any desired position, leaving a big margin for adjustment. In deciding the height of the engine foundation and the countershaft, care should be taken to allow sufficient room for the belt to clear the bedplate of the engine room walls, and the bottom of the shed bearers.

A cross-section should be drawn to scale at right angles to the length of the shed, and in the same plane as the grader pulley. In this will be shown the floor of the shed, and also the bearers, joists, and countershaft. It will then be possible to place the grader and the countershaft in such positions on the cross-section as to enable the belt to dodge the bearers and joists and also to determine the exact position of the two holes in the floor, through which the belt is to pass. In the case of this shed the centre bearer, which runs parallel to the length of the building, passes midway through the belt.

It is also a matter of considerable importance to arrange that the drive, in all cases, comes on the lower half of the belt, as otherwise the amount of slip will be greatly increased. For similar reasons the belt from the countershaft to the grader should not be vertical but should be inclined at between 45 and 60 degrees. Lack of care in the arrangement of the belts will give rise to trouble with the grader. Slip of the grading belt, or of the driving belts, tends to give rise to the bruising of fruit (which normally does not occur at all), or, if it is considerable, to the jamming of the grader.

Fruit from the orchard is brought in through sliding door A, from a cart which holds 14 cases, which, after allowing for rejects, is equivalent to from 10 to 11 packed cases. It is found that, on the average, a man and boy can pick and cart 8 loads per day. The feed table of the grader holds from 8 to 9 cases, and, if the machine is started as soon as tipping from the cart has commenced, it will be possible for the carter to tip the cases as quickly as possible, and take them back to the cart without stacking. In wet weather, a reserve of fruit can be stacked, as shown on Fig 1, sufficient to allow it to dry before packing.

The amount of fruit mentioned—from 80 to 90 cases per day—can be handled by one full-time, and one part-time packer, and as long as this amount is not exceeded for more than a day or so, all the rest of the shed work can be comfortably done by one boy. A larger amount would necessitate an additional man, to assist with the shed work and picking.

The end of the grader is connected with a Lightning Lidding-up Press, by means of a Gravity Conveyor, 16 feet in length, consisting of a series of parallel rollers, running on roller bearings, and set, together with the press, at a height of 26in above the floor. Fig. 5.

After the packing of a case is completed, the packing trolley is pushed to a point just clear of the end of the grader, and the case is lifted from it, 3ft. to the conveyor. The size of the apple is then stamped on the case with a rubber stamp, and a light push sends it to the press, into which it runs on the rollers.

When the line of rollers contains about 12 cases, strawboards and lids are put on each case, and they are run successively into the press. By pressing down the large pedal, Fig. 5, which remains in position till it is released, the lid is pressed down evenly at each end, and held down by a device, which leaves the way quite clear for nailing, nails and hammer being carried on the shelf at the back of the machine. The size and name of the apple are then stencilled on the remaining end of the case. A touch on the smaller pedal then releases the press, which rises into its original position. The case is then lifted off and stacked, in the

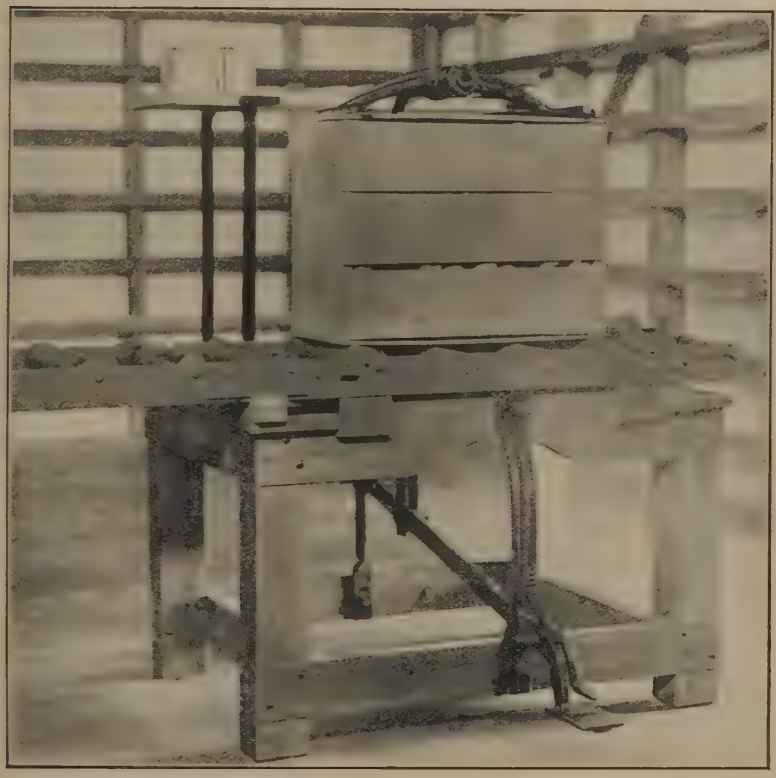


Fig. 5.—Lidding-up Press.

positions shown on Fig. 1, where there is space for 1,200 cases. It will be noted that, after having been tipped on to the grader table from the cart, the fruit has been lifted 3 feet to the conveyor, at the same level, and an average of about 12 feet to the stack.

All the above operations can be carried out without stopping, and cases may be lidded up, stencilled, and stacked comfortably at the rate of 75 per hour. A further advantage arises from the fact that the lids are pressed down evenly and gently, at both ends. They show no tendency to split, and the fruit is not forced

diagonally towards one end of the case, as when the lid is pushed down in the usual manner. It will be seen in Fig 5 that the two central rollers in the press are set at a lower level than the others, in order to allow for the bulge of the bottom of the case.

In order to protect the walls of the shed from damage from the inside, pieces of 2in. x 1in. jarrah are nailed horizontally to the inside of the studs, at 9in. centres, throughout the shed, to a height of 7 feet above the floor, Fig. 5.

It will be noted that the shed is placed with its longer axis running east and west. With the exception of the 3ft. x 2ft. and 2ft. 6in. v 2ft. windows, which light the fruit-receiving annex and the engine room, all the lighting is from the south side. Windows measuring 12ft. x 2ft., 9ft. x 2ft., and 6ft. x 2ft. are placed opposite the lidding-up press and rollers, the grader, and the case-making bench respectively, the bottom of the windows being 8 feet above the floor, Fig. 3. This lighting is supplemented by four sky-lights, set in the south slope of the roof, two being placed over the grader bins, one over the elevator, from which the rejects are picked out, and one over the case-making bench.

Since no sun ever shines on the south wall, direct sunlight never penetrates the building, and the various sources of light, aided by the reflection from the asbestos walls, produce an absolutely flat and uniform light, which casts no shadows anywhere.

It will be seen that the keynote of the whole design lies in the making of the packing a continuous process, the elimination of all unnecessary motions, unnecessary lifting and carrying, and the exact synchronisation of all sections of the process.

Experience of the results shows that in this direction lies the chief hope of a substantial reduction in the handling costs of fruitgrowing, and any grower who reorganises his operations on the above lines may look forward confidently to results which will exceed his most sanguine expectations.

FACTORS INFLUENCING THE PRODUCTION OF CLEAN MILK.

M. CULLITY, Senior Agricultural Adviser, Dairy Branch.

During the last three years, in which it was found necessary to export butter overseas, the necessity of the greatest care in the production of milk and cream by the farmer, and efficiency in handling this raw product during manufacture, with a view to the production of a product of highest quality, has been often demonstrated.

Whether engaged in the production of cream for butter making, or of milk for human consumption, this milk must be primarily of "good keeping quality," which is found to be closely correlated with low bacterial content.

The bacteriological content has reference to the numbers and kind of bacteria present. Bacteria are extremely small organisms which are invisible to the naked eye. They are everywhere, in the air, soil and water and in uncountable numbers. It is impossible to overestimate their importance. They carry out all sorts of work, often useful, *e.g.*, nitrification in soils and in the ripening of cheese. A very important work is that of ridding us of dead organic matter by the processes of fermentation and decay. While much useful work can be attributed to their action, certain kinds are the cause of various diseases which afflict the animal and plant kingdoms.

These organisms require food for existence, and depending upon the conditions under which they are found, so their rate of development varies. Under optimum conditions, as will be shown later in the section dealing with cooling, the rate of multiplication is extremely rapid.

As it happens, milk is an extremely good medium for the growth of certain kinds of bacteria, and while all of these may not be harmful to humans, their presence has a definite influence on keeping quality.

Barkworth, Mattick, Taylor and Stenhouse Williams at the Reading Institute demonstrated that according as there were a rise in bacteriological content, so there was a steady fall in the length of time the milk would keep sweet. This supports the usual measure of practice; the housewife generally judging the quality of the milk by observing whether the milk will keep for a reasonable period or whether it goes "off" or sours quickly.

Further, it was shown that when B. Coli was present, the deleterious effect on keeping quality was much more severe—B. Coli being an undesirable organism in milk, of which various types are definitely intestinal and gain access to the milk directly or indirectly from dung.

Therefore it is obvious that if milk is to keep for any reasonable period, it must be produced and treated under conditions where the numbers of bacteria gaining access and developing, are kept at a low point—that is, milk of "low-count" must be produced.

It has been repeatedly shown that the factors governing the production of milk of low count may be grouped under a small number of headings. The results obtained from Clean Milk Competitions in Wales reported by S. B. Thomas in the Welsh "Journal of Agriculture" are typical.[1] He states that a survey of the methods used show that the four chief factors in the production of clean milk are as follow:—

(a) Sterilisation of the utensils by steam or scalding water.
(b) Attention to details during milking.
(c) Cooling to as low a temperature as possible immediately after milking.
(d) The personal factor.

The more common aspects affecting the quality of the product may be treated as under:—

Atmosphere.

The atmosphere during the winter months is not a very serious contaminating feature, except where dry, dusty feeds are fed during milking or where the floor of the shed has been swept while dry prior to the commencement of milking.

In the summer months, however, the risk of contamination is greatly increased, inasmuch as dust is usually present in the air to a greater degree. The movement of the cattle in the yards creates this in large amounts, which finds its way into the milking sheds.

To reduce the possibility of contamination, it is advisable to design the buildings in such a way that a minimum of dust enters. The movements of the cows should also be studied, so that unnecessary driving is obviated.

While the sum total of the effect of atmosphere in our condition is usually not so severe as some other contaminating features, many of the types of bacteria that enter milk in this way are particularly objectionable and undesirable.

The Health of the Herd.

This has little or no influence on the total bacteriological count unless actual disease of the udder is present. In these cases, however, usually other abnormalities are present which will render the milk unfit for use.

The effect of the presence of such specific disease organisms as that responsible for tuberculosis is beyond the scope of this article.

The effect of mammitis in increasing the numbers of organisms is well shown by the following results from Wales:—

Cow.	Normal Quarter.	Inflamed Quarter.
Nancy	55	11,200
Sybil	1,450	156,000

The possibility of serious trouble with contagious mammitis is more likely where a milking machine is in use. The starting of the cows by drawing off a little fore milk is necessary to enable the operator to note whether the udder is in good order and to prepare the teats for the fixing of the teat cups.

The rejection of the fore milk should never be on to the floor of the shed, but into a bucket to be kept separate from the bulk.

The Coat of the Animal.

Contamination from this factor involves material falling into the milk during the milking process. This dirt includes manure, soil, hairs, etc., carrying organisms in considerable numbers, usually in groups which become broken up and spread throughout the milk. The greater portion of the dirt present in milk usually gains entrance from the body of the animal during milking. This may be minimised by keeping the coats in good order and by wiping the flanks and udder with a damp cloth prior to milking. The necessity for cleanliness of the teats is obvious.

Stocking of the New York Experiment Station obtained the following results, which indicate the effect of care in cleaning the cow.

Contamination of Milk by the Dirt from the Udder and Flank.

	Bacteria per C.C.		
	Total.	Acid Producing.	Liquefying.
Udder and Flank not wiped	7,058	3,554	81
Udder and Flank wiped	716	185	47
Decrease due to wiping	6,342	3,369	34

Milking.

The rejection of the first jets of milk from each teat means the rejection of that milk containing by far the greatest number of bacteria. While this is necessary in order to attain a high standard of production, it does seem absurd to see milkers very carefully do this and then more than nullify the good effect by some practice which results in seeding the milk with a still greater number of bacteria.

The table under gives some idea of the comparative bacteriological contents of fore milk, mid milk and strippings.[2]

Cow.	Fore Milk.	Mid Milk.	Strippings.
Berriers II.	3,040	304	574
Laura	310	13	455
Nancy	11,520	1,650	760
Betsy	3,780	376	210
Mabel	20,800	810	788
Jean	1,680	709	125
Average, 18 samples	4,605	1,329	662

That milk drawn with clean dry hands is cleaner than milk obtained by hands wet or greased with petroleum jelly or other substance has been definitely shown by Boyes and McClement of the National Institute, Reading. The results of the trials showed that no B. Coli was present in milk drawn with dry hands, while that drawn with greased hands was slightly better than when wet milking was practised (both systems, however, showing B. Coli).

The advantage of dry milking was emphasised further when the bacteriological counts were considered, the dry hand method being easily the superior, while the greased hand method was considerably better than the wet hand method.

The following table shows the results:—

Bacteriological Count.

Method of Milking.	Number of Samples.	Bacteriological Count—Number of Samples.			
		0-1,000.	1,001-10,000.	10,001-30,000.	Over 30,000.
Dry	30	22	6	...	2
Wet	30	3	16	4	7
Greasy	30	15	10	2	3

The samples were then tested for sediment and the results tabulated, again showing the milks from best to worst in the same order, that is, dry, greasy, wet.

It is particularly necessary, therefore, to take exceptional care in preparing the cow and in the actual milking. Long hairs should be clipped from the udder, the teats must be properly cleansed and dried with clean cloths and water containing a little disinfectant, preferably a little Condy's crystal. The milker's hands must be kept in a clean condition and an ample supply of water should be on hand for washing purposes.

Milking Machines.

Machines have been the subject of several investigations, all of which tend to show the liability to the production of milk of high count (or low keeping quality) in the hands of any but very careful operators. In every case known to the writer, where a direct comparison of hand-milking and machine-milking under ordinary farm conditions has been made, the result has been against the machine. It, however, has been abundantly proved that, with careful operation, milk of low count can be produced. This is possible only where strict attention is paid to all details and efficient sterilisation is carried out. The teat cups and rubbers are usually a serious source of contamination, as has been pointed out previously.

The vacuum system—usually the most neglected part of the machine— is often responsible for the seeding of large numbers of bacteria into the milk, even where the rest of the equipment may be in faultless condition. Mattick and Proctor[3] showed definitely that the vacuum system was causing considerable contamination, and they suggested improvements which were incorporated in later machines. They also showed that the milking units and their rubber components may be successfully sterilised by steam without seriously shortening the life of the rubber parts. The United States Department of Agriculture also states that the temperatures used in sterilising rubber equipment have not been more detrimental than the other methods of sterilisation.

In bucket type machines, the buckets, rubber parts, and vacuum system comprise nearly the whole of the contaminating influences. In the releaser type of machine, however, there is in addition the long overhead milk pipe, the connecting

down-pipes and the releaser apparatus. This all means additional surface over which the milk must pass and which must be sterilised before satisfactory results can be expected.

The most satisfactory method of washing machines already has been described but may be recapitulated here.[4]

1. Before milking, draw cold water through all milk tubes and the releaser so as to prevent the adhesion of milk to the pipes, etc.

2. Immediately after milking wash all dirt off the outside of the teat-cups and rubbers, then draw through each set of teat-cups sufficient cold (or preferably warm) water to flush out the milk system. When drawing the water through the set farthest from the releaser, insert a ball of horse hair in the end of the milk pipe to cause it to travel through to the releaser with the water.

3. Next draw through *each set* of teat-cups *not less than one gallon of boiling water* to which caustic soda has been added at the rate of *not less than* 1 *to* 1½ *tablespoonsful per* 4 *gallons of boiling water.* Distribute the solution as evenly as possible through each set of teat-cups.

4. Immediately follow by flushing out the caustic soda solution with 2 gallons of hot water or 1 gallon of *boiling water* for each set of teat-cups; the flushing with boiling water helps to dry the rubbers and leave the milk system dry and sweet.

5. Then remove or open the plug or flap from the releaser pipe to allow of free circulation of air.

6. Next *clean the vacuum system* in the same manner as the milk system by drawing through first the caustic soda solution and next the boiling water which has been circulated through the milk system. Pay particular attention to the cleaning of the pipe connecting the releaser to the vacuum tank, by flooding the releaser to cause the water to travel through to the vacuum tank. This is important.

7. The engine can now be stopped. *Disconnect the two long rubbers* from down-pipe and teat-cups and hang in a clean, airy place out of the sun.

8. Next disconnect the releaser, wash, rinse, and place in a clean dry sunny place, then disconnect the top or bottom half of the vacuum tank and treat in a similar manner. *To be successful these operations must be carried out daily.* This does not dispense with the necessity of dismantling the machine as often as possible so that points and crevices may be examined and treated.

The effect of using boiling water throughout the machine before milking and then cooling the machine is very efficient in reducing the count (see later, Sterilisation before use).

Washing of Utensils.

In washing utensils there are three main processes which may be summarised as under:—

1. Removal of milk film by rinsing with cold or luke warm water. Should this be neglected and hot water used directly on this film, there will result a greasiness of the parts with the ultimate formation of a scum or milk stone.

2. Cleansing in warm water containing a little soda or other cleansing agent using brushes.

3. Sterilisation.—Delayed washing, though usually thought to have little effect on the ultimate count, generally exerts a very direct influence due to the greater development of bacteria on the vessels before washing.

The trials referred to above also gave results showing the average count in milk—where utensils were washed directly after milking—to be 666,520 per cubic centimetre, while, where washing was delayed for eight hours the count was 1,677,000 per cubic centimetre.

. Sterilisation of Utensils.

The condition of the utensils exerts the greatest single influence on the bacteriological content of the milk. Improperly washed utensils exert an effect that is too obvious to need emphasis. Where washing is carried out thoroughly and sterilisation neglected, there is still a serious contamination. Prolonged heating with steam will not render utensils perfectly sterile, and it is certain that heating under the conditions usually carried out does not do the work required as effectively as the operator wishes.

To obtain as efficient sterilisation as can be wished for on a farm would necessitate the installation of a steaming compartment. This is beyond the resources of producers at the moment. But yet a simple effective method is that suggested by Proctor and Hay, of the National Institute of Reading, and previously prescribed in this Journal. This in essence is the furnishing of a small tank in which the smaller equipment may be placed and the whole put in position over a steam pipe from an ordinary boiler or copper. This system is not beyond the reach of many of the producers. The most common equipment, however, is the copper alone. In the great majority of cases this can be utilised more efficiently than is actually the case. To obtain the greatest effect the water must be boiling and the equipment placed therein for at least 15 to 20 minutes. Unfortunately, however, this procedure is not common, and what one usually sees is the splashing of hot water (usually not more than 140 degrees or 150 degrees Fah.) over the equipment. This is not sufficiently effective, and an extension of the time of exposure to heat must be made to achieve more efficient sterilisation.

Exposure for one minute to a temperature of 200 degrees Fah. is as effective as 20 to 30 minutes exposure to a temperature of 100 degrees Fah. So, naturally, if boiling water is not available, the period of immersion must be lengthened considerably. A good plan is to place all parts, sufficiently small, in the copper, and to allow them to remain there for some time.

Sterilisation of Milking Machine.

It is particularly necessary that sterilisation of the milking machine be as complete as possible. Boiling water may be used for rinsing out the pipe lines, etc., but its effect is nullified if the temperature of the pipes, etc., is such that the water is cooled to a point where its work is ineffective. Care should be exercised to see that all parts of the machine are heated to as high a temperature as is possible with boiling water or steam. A very important effect is that a self-drying degree of heat is imparted, enabling the parts to drive off all moisture, thus rendering the growth of bacteria a slower process than where moisture is present.

The following table shows the comparative effects of steam and boiling water as sterilising mediums, compared with effects where utensils were washed, but not sterilised.

Sterilisation of Utensils.	No. of Farms.	No. of Milk Samples.	Average No. of Bacteria c.c.	Per cent. Samples in which Coliform Organisms detected.	Average keeping quality (days).
Efficient steam sterilisation	22	157	20,340	29	3·75
Efficient use of boiling water for sterilisation	44	308	61,000	48	3·48
Utensils washed, but not sterilised	21	158	467,000	94	1·90
Total	87	623			

The decline in keeping quality where no sterilisation was carried out is most striking.

Effect of Sterilisation Before Use.

After washing utensils are usually left for several hours before the next milking, and in that time a considerable increase in the number of bacteria occurs. Where the vessels remain wet for any reason after scalding, the growth of bacteria is more rapid than where the utensils dry out quickly.

Where a second scalding is carried out again before use, the destruction of most of the bacteria occurs, and a very improved result is obtained. This fact was demonstrated in trials carried out by the Public Health Department for the Royal Commission on the Whole Milk Supply in Perth in 1925.

Seven samples taken after passing over the cooler into a drum, after mere "cleaning" of the reservoir cooler and drums, gave the following counts:—

Total 45,000. Coli 4.

Eight samples taken after passing over the same utensils after they had been dipped in boiling water, gave the following results:—

Total 2,045. Coli 2.

Clemmer, of the United States Department of Agriculture, obtained the following actual results:—

Influence of Sterile Utensils on the Bacterial Content of Milk.

——	Utensils not Sterile.		Utensils Sterile.	
	Number of Samples.	Average No. Bacteria per c.c.	Number of Samples.	Average No. Bacteria per c.c.
Open pail	26	497,653	36	22,677
Small top pail	28	368,214	36	17,027

A similar result with milking machines was obtained by Leitch.[5]

——	Sample A.	Sample B.	Sample C.
Unit treated with hot water before milking	8,100	7,900	19,500
Unit untreated with hot water before milking	1,600,000	316,000	515,000

The results indicate that the sterilisation of the utensils immediately before use in many cases made all the difference between the production of high and low count milk.

Cooling.

The necessity for cooling the milk after it has been drawn has been emphasised in previous articles. After the milk has been obtained, this is the most important factor in restraining the development of bacteria.

The following table shows clearly the effect of temperature upon the rapidity of multiplication of bacteria and on keeping quality:—

No. of Bacteria c.c. at outset.	In 12 hours at 50 deg.	In 12 hours at 70 deg.	In 50 hours at 50 deg.	In 50 hours at 70 deg.	No. of hours before Curdling at 50 deg.	No. of hours before Curdling at 70 deg.
46,000	39,000	249,500	150,000	542,000,000	190	56
47,000	44,800	360,000	127,500	792,000,000 (36 hours)	289	36
50,000	35,000	800,000	160,000	2,560,000,000 (42 hours)	172	42

(Bulletin 26, Storrs Sta., Conn.).

Various types of bacteria have different temperatures at which they develop most rapidly. At the temperature at which the milk comes from the cow development of Coliform and other gas producing organisms proceeds at their maximum rate. After the next process on the ordinary farm, the water cooling, the temperature is usually reduced to the vicinity of 70°F (summer) at which temperature a different type of bacteria thrives, the lactic acid producing group, which are not considered harmful to health, but which if allowed to develop, reduce the time in which the milk will remain sweet; they cause souring. To prevent this from proceeding, where the milk has to be kept, it is necessary to reduce the temperature to a lower point, 40-50°F., where bacterial growth is comparatively slow. This can be achieved by the use of the brine cooler.

The cooling of milk to a low temperature immediately after milking is necessary in order to safeguard keeping quality. This effect may be nullified, however, if the cooler is allowed to be operated without first having been scalded. The investigations carried out by the Public Health Department in 1925 demonstrated the increase in the numbers of bacteria occurring in the passage of the milk over the cooler.

	Before Cooler.	After Cooler.
Sample 1	3,120	132,000
„ 2	1,800	8,000
„ 3	7,110	105,000
Average	4,010	81,666

Water Coolers are most effectively scalded by placing in a tub or copper of boiling water. The usual method of allowing hot water to run over the surface is often futile.

Brine Coolers are difficult to deal with under farm conditions as they are often too large to be placed in the usual size of boiling apparatus. The ordinary method of scalding seen is the running of a quantity of hot water over the cooler, or the throwing of buckets full of water against the surface. When one considers that the usual small brine cooler is fitted in such a way that the cold brine is still inside the pipes to be sterilised, it can readily be understood that the ordinary attempts at scalding are farcical. Actually the cold brine cools the heating medium before any scalding effect is obtained. That the brine cooler, though clean visibly, can be a serious source of contamination has been shown recently in this State during investigatory work carried out by this Department. It was demonstrated that a small brine cooler, although bright and clean on inspection, was actually seeding the milk with B. Coli. Actual sterilisation of this piece of equipment had never been carried out.

The provision of a by-pass or some system whereby the brine can be returned to the storage tank would facilitate scalding of the cooler itself.

Strainers of various types are in use and in many cases are doing damage to milk. The all-metal strainer is only efficient in catching the larger particles, and there is always the possibility of its gumming up, particularly at the edge. Sterilisation can only be achieved in these types by a period of boiling.

The cloth strainer should never under any circumstances be used twice without boiling and drying in the direct rays of the sun. Where the cloth is allowed to dry, as is usually the case, thrown over the cooler, or on a small line in the dairy, drying is slow and the bacterial multiplication proceeds extremely fast. The result of this is that the cloth becomes a very serious contaminating medium when again used.

The most effective type of strainer is that which uses a wad of cotton wool between two metal perforated discs. The wool is used once only and then discarded, a fresh wad being put in place at each milking. This type of strainer removes practically all visible dirt which finds its way into the milk.

Storage.

After the milk has been cooled it is necessary to provide a storage room where the temperature can be kept constant at a low point so as to prevent any great alteration in the count of the milk being held.

Transportation.

Precautions are necessary here again on the same principles as the preceding section. The temperature of the milk has to be kept as nearly as possible at a low point. This can be achieved by shortening the period of transportation, reducing the temperature to a particularly low point and using precautions to prevent heat reaching the vessels in transit. Thomas and Lewis showed that a rise of 10° F. in transit decreased the keeping quality by one day.[6]

Personal Factor.

That there is a considerable difference between the results obtained by various men working under exactly similar conditions will be accepted. Actually the personal factor may be regarded as the crux of clean milk production, as unless keenness and a desire to produce a good article is evident, the tendency is to neglect the details which means the difference between efficiency and inefficiency. Details overlooked in milking, in washing and sterilisation of utensils, in cooling, etc., nullify any advantage that may be gained by working in good premises with good equipment. It may be stated that a good operator in poor surroundings will usually produce a cleaner milk than a poor operator with good equipment.

A special study was made of the personal factor as applied to the production of milk with a low count on small farms.[6] *The buildings and equipment were generally poor, but personal efficiency and care in the methods of production counteracted this handicap.*

That an incentive to produce clean milk by way of paying a premium has a considerable effect in concentrating attention on the details which govern low counts has been recorded by North.[7]

Influence of Various Factors on Bacterial Content of Milk.

Date.	Bacteria per c.c.	Remarks.
December 26th	5,500,000	Tests begun.
„ 31st	3,000,000	
January 6th	1,000,000	
„ 13th	500,000	Weather freezing.
„ 29th	800,000	
February 12th	900,000	
March 5th	700,000	
„ 12th	250,000	Small top pails.
„ 19th	250,000	
„ 26th	80,000	Pails and can sterilised.
April 2nd	1,000,000	
„ 9th	70,000	
„ 16th	35,000	Premium paid for low count.

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THE SELECTION AND TREATMENT OF BANANA PLANTS.

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It is increasingly realised that to improve the standard of crops it is necessary to select from strong, robust, heavy and good quality producing stock. When selecting bananas for propagation not only the parentage but the progeny itself must be considered because of the all important part it plays in the ultimate success of the plantation, and with the heavy initial outlay for the grower in this State compared to other parts of the Commonwealth, it is necessary to procure the best planting material possible both to ensure early and profitable returns and enhance the disease-resisting qualities of the plantation. It will be agreed that the planting of inferior banana stock will result in the plantation producing low grade bunches and poor quality fruit, but many experienced growers do not realise the necessity for the observation of more exacting details when selecting propagation material and the early attention some types of plants require.

SUITABLE MATERIAL.

Various parts of the banana plant may be utilised for propagation purposes, such as suckers, corms, butts, bits or eyes. At the present time in this State suckers are practically the only planting material available, and it is intended that these notes should deal more especially with the selection of this particular type of planting material. Before doing so mention might be made of the usage of corms, butts and bits or eyes. The opportunity of obtaining these types of planting material is likely to be scorned by the new or inexperienced grower as being unsuitable, but good types of butts or pieces may give as good results as suckers providing they are properly handled before and after planting.

Butts are generally obtainable from old or well established plantations which have become unprofitable. There are two types of butts, viz., the one that is secured from a growing plant and the one that is taken from a plant that has produced a bunch. The former type is the more desirable as it usually produces a better first bunch. The usual custom when selling butts is to divide the butt into two or more pieces—the cutting into sections or pieces being so performed that each piece possesses one or more strong eyes. Butts may also be planted whole but it is advisable to destroy all but one or two of the strongest eyes. (The surplus eyes

can be destroyed by gouging from the corm prior to planting.) Good butts prove excellent for use as refills within the established plantation, thriving better than any other propagation material for this purpose.

When planting pieces or bits the cut surface should be turned uppermost, and therefore the eye or uncut surface will be in the bottom of the hole. Pieces usually take a little longer to come into bearing than is the case with butts. The use of eyes or bits cannot be entirely recommended for the Gascoyne district as they are liable to dry out very quickly and may possibly decay under irrigation. After subdividing the corms it is well to permit the cut surfaces to dry out a little prior to planting.

In the selection of suckers the intending grower should observe the vegetative growth, the producing qualities and the freedom from disease of the plants within the plantation from which he intends securing his plants. It is conceded that if the plantation is healthy, vigorous and producing good quality fruit the progeny should reproduce on similar lines.

Generally speaking the average plantation is considered to be in its prime between the age of three to six years, but it is suggested that growers take this as a guide only, for some plantations of less mature age may more than favourably compare with plantations between the ages mentioned.

ONE-YEAR-OLD STOOLS.

The selection of suckers from one-year-old plantations is much to be discouraged, not only because of the inferior quality planting material available (figs. 1-3) but the damage that may be done to the parent plant bearing or about to throw its bunch. Suckers selected from year-old plants cannot be expected to compare with suckers from a three-year-old stool (fig. 2), as the year-old plant must necessarily be producing offspring of tender growth which are only good quality plants in the making. No doubt there are exceptions, but when the damage likely to occur to the parent by the removal of suitable planting material is considered the wise grower will realise that the saving in the cost of plants or the money gained by the sale of such suckers will not recompense him for the damage to the young parent and developing bunch. The sucker being tender is likely to give poor planting results should adverse weather conditions be experienced, but should the grower find it necessary to use such material in establishing his plantation he should arrange for the planting to be carried out as quickly as possible after the removal of the sucker from the parent plant. Additional care should be taken during the removal of the sucker from the parent, both from the viewpoint of the young parent and tender offshoot.

Fig. 1 depicts six suckers taken from a one-year-old plantation, and only B and C are fairly suitable plants for propagation purposes. Note the area that had to be severed from the side of the parent to permit the removal of suckers A and B.

Taking the well developed plantation as the grower's best guide, the best type of sucker to select must be considered. Opinions vary even amongst experienced growers as to the stage suckers should reach before removal for transplanting. The fact is generally acknowledged that the later in the spring suckers are removed the better, but it must not be forgotten that the plant or sucker planted late may have to commence its new life under rather severe climatic conditions on the Gascoyne. Suckers six to eight months old are favoured by some growers, their method being to eliminate the centre growth and allow the first followers to produce the first bunch. When using this type of plant, if this practice is not adopted the grower may anticipate an early bunch of rather inferior fruit compared to the bunch that would be carried by the first follower were the original centre growth destroyed.

Fig. 1.

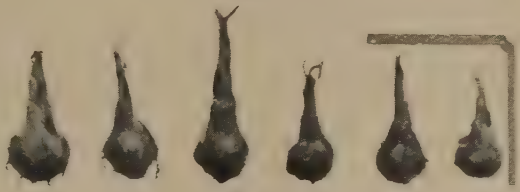


Fig. 2.

Fig. 3.

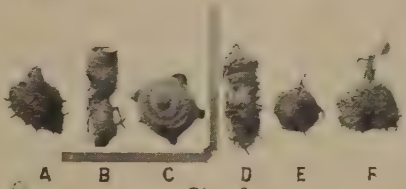


Fig. 4

Fig. 5

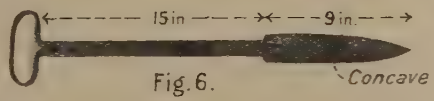


Fig. 6.

(1) Typical type suckers from an average 1-year-old plantation. B & C are good type suckers in the making. Compare these plants with those in Fig. 2.

(2) Spear point or sword suckers from 3-year-old stools. Note the bulbs and tapering barrels compared to suckers depicted in Fig. 1.

(3) Suckers from a very vigorous 1-year-old plantation dug late in the planting season. Suitable for planting if given suggested additional treatment.

(4) Propagation material from a run-out or declining plantation. Such material should never be used. F is typical onion bulb.

(5) Another group of inferior type plants usually obtained from a declining plantation. Such material should be strictly avoided.

(6) Banana Gouge. Note the concave or spoon-shaped blade, *the edge of which should be sharp.*

The size of the sucker is not a true guide to quality for the rapidity of growth of suckers varies tremendously. The main points to keep in mind are that plants should possess good solid bulb formation with the pseudostem or barrel of the plant tapering from the bulb to the apex, the leaves growing fairly upright being small and narrow; such type suckers are commonly known as "spear points" or "sword" suckers. Strictly avoid suckers with small bulbs possessing barrels of more or less even girth from bulb to apex, with broad spreading leaves. These are known as "umbrella" or "water" suckers and are slow developing plants producing inferior bunches. Fig. 2 describes good type spear points or sword suckers removed from three-year-old stools and are far superior to all suckers in Fig. 1.

REMOVING THE SUCKER.

The utmost care should be taken during the operation of removing the sucker from the stool both for the good of the sucker and parent plant. The mattock, shovel or hoe are not very satisfactory tools for severing the sucker, and the operator should use a suitable bar, similar to a crowbar, the blade of which should be long, flat and wide and possessed of a sharp edge. For convenience of working the blade portion of the bar may be set at an angle to the main shaft of the instrument, the whole implement being of sufficient weight to give a good fall.

The soil should be removed from between the parent plant and sucker so that the operator can detect the union of the two plants. The bar is then placed at the narrowest part of the union and forced downwards. With large suckers it is necessary to remove soil from both sides before attempting the removal, and it may be found necessary to aim the bar at the point of union of the two plants. Never attempt to remove plants that are wedged between two adult plants, for not only is the young plant likely to be damaged, but considerable root surface on the adult plants will be destroyed. The entire operation should be one of gentleness—no more force than necessary should be used when loosening the sucker. With the most careful and methodical operator there is likely to be a percentage of damaged suckers and these should be discarded. The honest vendor will not supply damaged or otherwise unsuitable plants that he himself would not plant.

AFTER REMOVAL.

All leaves should be removed to minimise transpiration and all roots cut off close to the bulb or corm. With large plants it is advisable to cut back the top portion of the barrel to within about eight inches of the crown of the bulb in preference to only removing the leaves. The cut should be made on the slant and high enough up on the stem so that when the sucker is planted the irrigation water will not cover the cut surface (this point relates more particularly to late planting). Where suckers as depicted in Fig. 2 are being used as planting material it is optional to remove any of the top growth. As a precaution against fungal infection of the sucker after removal from the stool the cut surface of the plant may be turned to the sunlight for several days when the sappy surface will harden and thus reduce the possibility of corm trouble. This precautionary measure should also be adopted with cut up butts but is not recommended in the case of suckers from year-old plants. The habit of certain growers of rubbing the freshly cut surface of the sucker or bits in the soil is a bad one, as this action is liable to introduce soil fungi and bacteria which may mean decay of the corm early in the life of the young plant.

All propagation material should be free of all soil and roots prior to removal to the intended planting ground. This precaution is necessary so that disease and pests which harbour in and about the corm may be detected.

DE-SUCKERING.

The pruning or reducing of surplus sucker growth from around the plant or stool is necessary if large marketable bunches of fruit are required. With this object in view the grower must formulate some method whereby this work can be carried out most efficiently. The entire digging out of the surplus suckers is not recommended as to do so necessitates the destruction or damage of much root surface on the remaining plants which naturally must have a detrimental effect on the forthcoming bunch. The work can be most successfully carried out by the use of what is termed a "banana gouge" or "de-suckering bar" (Fig. 6). By the use of this implement the growing point of surplus suckers can be destroyed without in any way disturbing the root system of the parent plant. This operation is best or most easily carried out when the surplus suckers are about one foot high; if the suckers are allowed to develop to a more mature age the work of de-suckering is increased and in the meantime unnecessary sapping of plant food is occurring.

The plant to be removed should be cut off at ground level with a sharp knife. The point of the gouge is then inserted just inside the outer edge of the base of the plant and with a little pressure and turning of the handle in an auger-like fashion the heart of the corm or bulb can be lifted out. The heart of the corm can be detected by the close white-grained tissue compared with the other parts of the corm. Until the operator has become accustomed to detecting the heart section it is suggested that he gouge right through the corm into the soil, when he will be satisfied that the vital portion has been destroyed.

The number of suckers that should be left around a stool depends upon such factors as the age and condition of the plantation, distance apart of stools, soil conditions, etc. In the case of a year-old stool no more than three followers of various ages should be allowed, and these should be so located that each one is as far apart as possible around the stool. In the regulation of suckers around a well developed stool, the main object should be to select offshoots of varying age so that not all plants are maturing their bunches at the same time. Three adult plants with three followers is quite sufficient growth to allow to remain if large bunches are required. Eliminate suckers that develop between the adult plants or in the centre of the stool as these suckers will seldom produce commercial bunches. The type of offshoot to leave can be selected on the same points that have already been mentioned when selecting propagation material.

THE MEDITERRANEAN FRUIT FLY.

(*Ceratitis Capitata.*)

By L. J. Newman, F.R.E.S., Government Entomologist.

The fruit fly during the last fruit season assumed plague form, being more numerous and widespread than ever before. A feature of last year was the increased attack on fruits which are normally only more or less accidentally invaded. There were factors which appeared to favour the increase of the pest, namely the very high humidity of the last summer and the advent of exceptionally early and copious autumn rains. These early rains appeared to not only favour the fly, but predisposed fruits to attack which normally are not regarded as suitable breeding hosts.

The fly was carried on in large numbers until the end of May. Although the winter has been a wet one, in the fly areas there has been a very active carry-over of the fly to September. These flies, together with those now emerging from pupae, derived from maggots which have fallen from citrus and loquats since May, are now, upon the advent of warmer weather, becoming active and are reproducing in ripe citrus and loquats.

Unfortunately, the general fruit-growing public have regarded this insect as being only active during the warmer periods of the year, and when the month of May is over, they regard the fruit fly season as ended, and with a sigh of relief decide that there is no need for further action until fly-infested fruit becomes plentiful in December. It has frequently been pointed out both by lectures, bulletins and press notices, that there is no month of the year under our climatic conditions that the fruit fly is not active; many tests to prove this statement have been carried out and the results published.

The life cycle of the fruit fly is certainly more rapid during the warmer months, but, nevertheless, we must recognise the fact that this pest is with us all the year round. Until the fruit-growing public do act upon this established fact and take the necessary action we shall never bring this very virulent pest under economic control. What is desired, is that the public should clearly understand that there is one time when it is easiest to effectively cope with any given pest. It is much better to attack it at the most vulnerable period of its life, than to wait until all the factors are favourable to the insect, such as the warmer summer period, with its abundance of available host fruits, provides the fruit fly.

As illustrations of the life cycle of the fruit fly during winter and spring, the following definitely proved examples of how this pest negotiates this period, are herewith given.

An egg deposited on the 1st of June could hatch, taking maximum periods, on the 20th June (20 days). The larva or maggot could pupate on the 4th of August (45 days maggot stage) and emerge as a fly on the 24th of September (50 days' pupation). Allowing 70 days as the average life of the adult fly, she would live and be able to function until the beginning of December, making a total life cycle, from the laying of the egg to the death of fly, six months.

Taking a second illustration. A larva or maggot pupating on the 1st June could issue as a fly on the 15th July (45 days) and live as a functioning fly until the 24th September. In each instance, if a fruit medium is not available or the weather is not sufficiently warm to stimulate egg laying, these flies can extend their life period up to 117 days.

The male flies do not live as long as the females, and hence in trapping during the winter and early spring the bulk of the flies captured are pregnant females. Fortunately few eggs are laid in citrus after the end of May, as the weather then becomes too cold. Every now and then, however, throughout this period, warm bright days do occur, and some eggs are deposited. The actual loss by fruit fly from June to November is comparatively of little economic importance.

In the case of citrus fruits, the eggs are frequently destroyed by the oil which exudes from the wound made by the insertion of the ovipositor. The oil flows or spreads over the eggs and varnishes them thus causing them to shrivel and die. Eggs laid into unripe citrus seldom develop maggots. As the fruit ripens, the skin gets thinner, thus permitting the eggs to be deposited in the flesh of the ripe fruit. In such cases the eggs will hatch and the maggots develop. Probably not

more than 1 per cent. of winter and spring citrus fruits carry the larva of the fruit fly to maturity. Many fruits may be struck and exhibit the typical mark, commonly known as the sting.

Loquats in like manner are not heavily infested. The one per cent. of fruit in the winter which has harboured the larvae of the fly, gives rise to the early spring flies of both sexes, which supplement those that have carried through as adults.

As soon as the weather warms up in late August, or early September, the flies which have survived the winter become active, and, if not destroyed, become the progenitors of the myriads which ravage our fruits in the summer. When it is realised that each female fly is capable of laying 300 eggs and that every 34 days during the summer (mid November to mid April) this fly completes its life cycle from egg to adult, the benefit of capturing the Winter and Spring generations is surely most obvious.

Growers should be more enthusiastic about the capture of the few flies in the off season than they are about the thousands caught later in the summer, realising that the ones and twos are the progenators of the future swarms. The capture of large numbers in the summer might be likened to an attempt to bail out the Swan River. Immense quantities of water may be removed with little apparent reduction, and so it is with the fly; large numbers may be trapped or destroyed and still myriads remain to carry on the work of fruit destruction.

It is not here suggested that no efforts be made to capture or destroy the fly in the summer, but that the best time to make an effective check upon the pest is during the winter and spring.

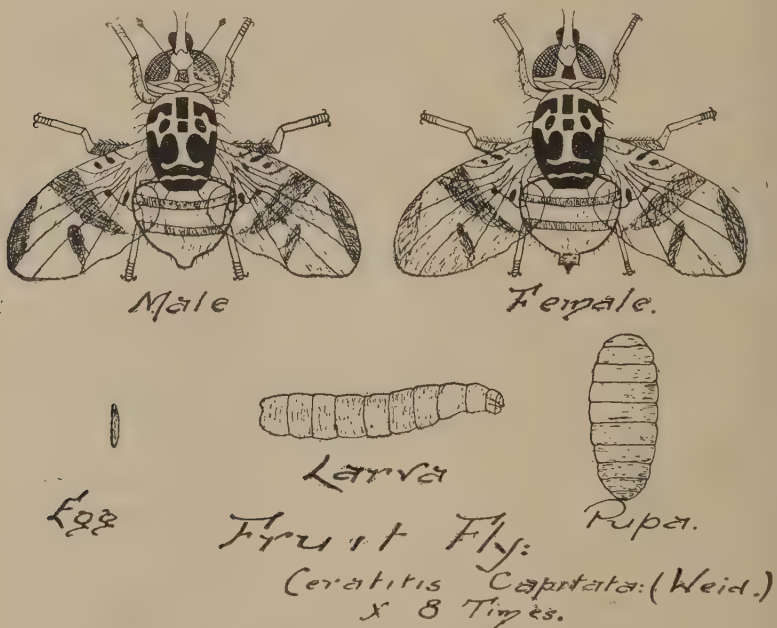
The citrus and loquat trees are the chief medium by means of which the fly is carried over from autumn to early summer. The shelter offered by the dense foliage gives protection against the elements. The odour emanating from the fruits causes the flies to concentrate there as the deciduous fruits cease to exist and the foliage falls. Further, citrus trees are very often infested with scale and aphis. The honeydew secreted or given off by these sap sucking insects is readily consumed by the fly and constitutes an effective food supply. The fact that the flies are so concentrated in these trees, gives the great opportunity to capture or poison them off. The fact that little loss occurs during this period is the cause of the lack of effort made by the grower to take advantage of this weakness.

It is absolutely necessary, in the interests of the fruit industry, that the general apathy towards the fruit fly be broken down and the public enthused with the knowledge that this pest, if attacked co-operatively, at the right time, can be brought below the danger line.

Life Stages.

The adult fly is two-winged, about the same size as the common house fly, and of the same general shape, except that the abdomen is slightly broader and in the case of the female distinctly pointed. In colour it is ochreous yellow, the back being marked with an irregular mosaic pattern. The wings, which are carried in a drooping position, are semi-transparent, marked with three irregular yellowish-brown blotches. The abdomen is hairy and marked with two broad silvery or light purplish bands on a yellow background. The legs are six in number and yellow. The eyes are large and in colour purplish red. On the head of the male are to be seen two extra spatulated appendages or horns, and the tip of the abdomen is much

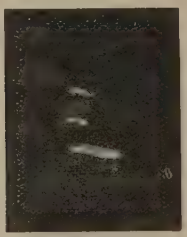
less pointed than that of the female. The eggs are pure white, elongated and slightly curved and are laid into the fruit, not the flower, in batches of 6 to 14.



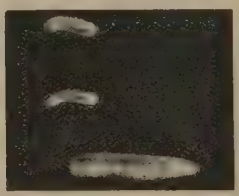
Life stages of fruit fly (original).

Imago or Adult, natural size.

The fully developed maggots are about one-third inch long, white to creamy white in colour, with small black hook-like jaws, with which they rend the cells of the fruit and make available the juice upon which they live. The maggot, by



Maggot, Natural Size.



Maggot enlarged 2½ times.

arching up its body, drawing the tip down to the head, can with a sudden muscular action jump a distance of 18 inches. The maggot of the Ferment fly often found

Outline of Maggot greatly enlarged, showing dorsal, ventral, and side view; also number of body segments.

in fruit which has been damaged or is in a state of decay, cannot jump, and, instead of being truncated or blunt at the posterior end, has the breathing spiracles situated on a tail-like protuberance.

Pupæ and Larvæ of Ferment Fly.

Outline of Ferment Fly Larva, showing breathing spiracles.

Adult Ferment Fly.

The pupa of the fruit fly is formed by the contracting and drying of the chitinous skin of the maggot into a small oval parchment-like case of a golden-brown colour. It is usually found in the soil, or under rubbish and litter, or at times is found in the corners of cases or other fruit containers.

Pupæ of Fruit-fly.

Fruit-fly emerging from Pupa.

Glass Cylinder containing 500,000 Fruit-fly Pupæ sieved from soil of neglected orchard.

CONTROL MEASURES.

First and foremost gather daily all infested fruits from trees and ground, and destroy by steeping in boiling water for five to 10 minutes. Every fruit laid

into, is a trapping medium, if such fruit is destroyed. This, if done systematically and co-operatively would, in itself, deal an effective blow to the fruit fly. Infested fruit may be destroyed by placing same in barrels containing water and a film of kerosene. The fruit would need to remain submerged for at least three days, when it can be disposed of by burying.

In careful tests made it was found that at least 72 hours submersion was required to destroy all the maggots. Barrels or drums may be placed at intervals in the orchard, the infested fruits collected and placed therein, and kept covered with water and oil.

BURYING OF INFESTED FRUITS.

If this method is employed, although not recommended, it is necessary to see that the fruit is covered with at least 15 to 18 inches of well-compacted soil. Infested fruit covered with less depth of soil forms ideal pupation conditions for the maggots, and is little better than if it were never picked up.

STORAGE ROOMS OR CELLARS.

These should be fitted with spring wire doors and screened windows. The storage of infested fruits is common. The eggs hatch in storage, and finally the larvae pupate in the crevices and about the floor and emerge later as flies. These flies escape again to the orchard, and thus, to a great extent, nullify the advantage of the daily pick-up of infested fruit.

Having done all possible along the first line of attack, namely, the daily destruction of all infested fruits, trapping and foilage baiting must be undertaken. In areas up to 200 trees trapping or luring with approved lures is advised. In larger orchards traps are used as indicators, and when the fly is discovered in the traps advantage should be taken of the first fine or suitable weather to apply the foliage bait. For further information concerning the making of the foliage bait and the composition of the luring or trapping mediums, see Leaflet No. 403, obtainable from the Department of Agriculture.

In conclusion, I would point out that the secret of success against this pest depends largely upon all making themselves acquainted with the habits and times of appearance of the fly, and to have a working knowledge of the preventive and control practices. In nature we have an energetic and ever wakeful taskmaster, who demands a fully alive pupil.

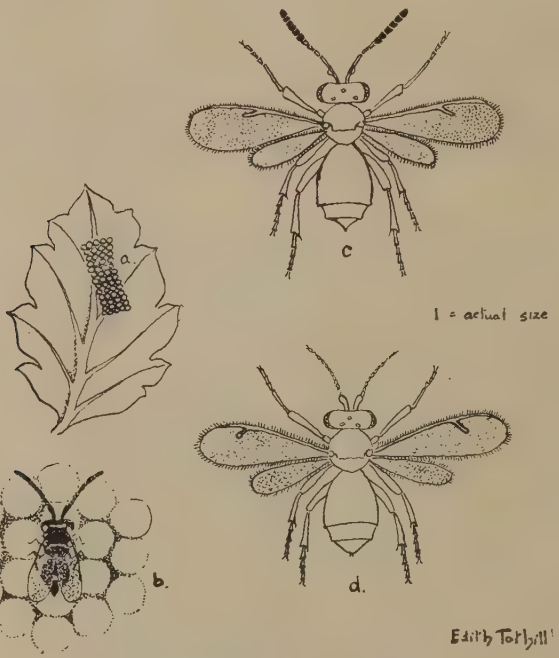
Co-operation of all concerned is absolutely essential if we are to conquer this most virile and destructive fruit pest.

THE GREEN TOMATO BUG EGG PARASITE.

(*Microphanurus megacephalus.*)

L. J. NEWMAN, F.R.E.S.,
Government Entomologist.

Last year the Department were successful in introducing this parasite from Egypt. A large number were bred and distributed to all parts of the South-West. Definite evidence was forthcoming, which showed that the parasite had reproduced in the field.



Microphanurus megacephalus, Askmead

(a) Egg raft (natural size)
(b) Parasite attacking eggs (enlarged)
(c) Female (multiplied by 13)
(d) Male " " "

As there was some doubt as to whether this wasp would negotiate our winter successfully in the field, a number of the wasps have been carried over in the insectary. An appeal is now being made requesting that growers will make every effort to forward as soon as possible any rafts of bug eggs they can find to the Entomologist, Department of Agriculture. The eggs are usually found on the backs of leaves of the plants attacked, and to be of use for the breeding of the parasite must be creamy-yellow in colour. If they have turned pink they are too advanced, and should be destroyed. If turning black leave them alone, as they are probably carrying the parasite.

The eggs supplied will be submitted to the parasite, and a proportion of them returned to the grower with full instructions how to place them.

POULTRY FARMING FOR THE BEGINNER.

G. D. Shaw,
Poultry Adviser, Department of Agriculture.

Poultry farming in Western Australia is increasing both as regards the number following it as an occupation and in egg value. Unemployment has forced numbers to embark on the production of eggs for profit so that within the ranks of the poultry farmers to-day are many who have little chance of success unless guided along the right methods of management.

To be successful in any industry means the continued study of that industry. At present, popular opinion is not above referring to poultry farming as only a "stop-gap"—something to fill in the time until other employment is available. During the last five years, poultry farming has increased in value to the State until to-day it stands very high in the list of primary industries. It has been one of the very few industries which have paid their way, so much so that it contains many farmers who are sure to meet with disaster unless the subject is studied closely.

The old established poultry farmer knows of the pitfalls liable to trouble the beginner. It is the beginner who needs the elementary advice in order to assist him to success, and to this end the present article is written.

The successful poultry farmers of to-day are, in the main, men and women who were owners or fanciers of a few fowls on a suburban allotment. They desired an extension of their hobby and invested in a small farm, built it up gradually while still working at their daily occupation and finally branched out into full-time poultry farming. They studied their subject and realised it is a highly technical occupation.

Unfortunately the period of unemployment caused many to scan the columns of the daily papers, select a picturesque advertisement and negotiate a purchase on the nominal deposit system and easy instalments with apparently no interest. In numerous cases the purchasers had no idea of the pitfalls confronting them and were obliged to sell out to others who would again follow in their footsteps.

Before embarking in poultry farming, one should serve an apprenticeship on a well-conducted farm or have had experience in the backyard. Poultry handled in small units presents few troubles but when handled in large numbers is a difficult problem for the beginner.

The first essential to poultry farming is the appreciation of the worth of a fowl, meaning, of course, whether one delights in the occupation. If you have no love for the birds, the industry is well left alone. One must be a constant admirer of the stock and study its management.

LOCATION.

Any soil of a light nature is suitable for poultry farming. Good drainage is of first importance and marketing facilities must be considered. Locate the proposed farm as near as possible to the best market, consider the condition of the roads carrying the transport and be sure there is an abundance of cheap water. Poultry farms located near the big markets have the advantage of cheap, quick transport with roads generally better in the more settled districts. The nearer the market the fresher the eggs should be on arrival.

SOIL.

The soil required in a poultry run need not be of the best. In fact, the poorer the soil the better the natural drainage and the cleaner the yards. Heavy soils have a tendency to foul very easily, while sandy soils filter the filth after each heavy

shower of rain. Coastal sand is the best, providing facilities are available for the growth of green feed in sufficient quantities. As much care and judgment should be exercised in choosing land for a poultry farm as for any other purpose.

When selecting a site, the poultryman must have a clear idea of how he is going to handle his stock, and plan accordingly.

STARTING.

There are two methods of starting—(1) to buy a going concern; (2) to build up from a virgin block.

(1) Poultry farms are on the market for various reasons. Only in isolated cases have the sellers a reasonable excuse, such as old age, sickness, or selling out because of having made enough in order to retire. We do hear of the latter, but more often of the former. One can examine these propositions with an open mind. Plenty of money is required to buy out either proposition as these farms are valuable. Most farms are on the market because the farm is unprofitable. That fact is not broadcast yet a casual glance at the purchase price and the deposit required will give a fair idea of the owner's value of his stock. Who is going to sell 500 laying fowls with all appurtenances for £50 deposit when a good average bird is worth at least 7s. 6d.? Yet these propositions are sold by the dozens to the sorrow of the purchasers, through the ultimate loss of their hard-earned savings.

At times a reasonable figure is desired, one which allows of plenty of cash left over after the deposit. The balance can then be applied in stocking and feeding to productivity.

(2) When starting on a virgin situation the position is one of self endeavour. One has no buildings to re-arrange to suit one's particular design, and advice from an efficient poultry farmer can always be procured in order to dodge the pitfalls. Correct design is applied and the farm built up on a well thought out plan of progress. Plan slowly. Many have ordered chickens before the sheds are ready. They have not given a thought to green feed, let alone water supply, and, casually send £50 away for the chickens—receive them and then find that the housing is not ready.

The sensible man can estimate that it will take time for water, green-feed and shedding to be established. He starts to arrange well ahead, perhaps 12 months before, so that when the rearing season comes along he has no rushed jobs. All he has to do is to feed and comfort his stock. He has studied his occupation and if he keeps going along those same lines he is a successful man, called "lucky" by the persons who failed. The poultry farmer must be a student of his occupation.

LAYOUT.

The student now starts poultry farming by building his farm on a virgin block or one that has no poultry buildings at present erected.

The first essential is a good water supply. Water is 90 per cent. of the farm's requirements. It is certainly No. 1 job.

Make the farm justify the residence. It is of no use having a £800 house if the stock cannot earn enough to justify the expenditure. Better to spend £200 only and put the rest into sheds and stock.

A brooder shed is *not* required. Under to-day's best practices the fowl shed is a thing of beauty and good management. It is the bedroom, dining room, drawing room and workshop all in one, not costly but certainly cosy. Designs are many and more or less efficient. Build one having the above attributes and it is excellent in which to brood the chicks. Add to it each year and brood the chicks in each new addition until you have sufficient housing for a self contained farm. The natural deaths and culling will then give plenty of idle space in February to June and then

brood the new chicks in that idle space. By this means the capital cost has been kept in use all through the year, whereas a brooder shed keeps capital idle from September to the following June. No banker would do that.

Dig and manure the lucerne patch in readiness. The water supply being assured get the grass going as soon as possible. As the lucerne lasts years it is worth preparing properly.

Build breeding pens and incubator shed for future use. How convenient then to receive the chicks knowing that sufficient shedding is completed without crushing. Time is available to concentrate on studying the stock and its progress.

Concentration to analyse the pros and cons of any article read makes for success. Many a fool may drop a gem of wisdom but it is the wise man who picks up that gem. Realise that we ourselves do not know the A to Z of poultry farming—the other fellow has part of the alphabet contained in his head.

Previously it has been stressed that stock is of foremost importance; it is; but running side by side is management. The best of stock is ruined by mismanagement, and the worst of stock cannot pay its way even with the best of management.

BREEDS.

What is the best breed of fowl? A question asked by many seeking advice when starting. One should never consider a breed as the best. The newcomer should consider which breed he admires best, buy the best of that breed to start with, and he will surely succeed.

Egg-laying competitions help the newcomer to ascertain who are the breeders of the particular breed he desires. These breeders advertise their birds as *their own* strain. Look down the advertisements in the Poultry Sales column of the local papers. It is noticed that you can buy White Lodge cockerels at 5s. from Mrs. "Blank," Subiaco. It is quite obvious that White Lodge cockerels were never bred by Mrs. Blank. This lady is selling under false pretences but the uninitiated falls. It should be understood that White Lodge strain is one of the best in Australia, but because a White Lodge cockerel was imported into a farm two or three years ago that does not justify the breeder in calling the progeny White Lodge strain. They certainly have that particular blood in their bodies but its virtues may have been ruined by the recent matings. Our breeders who advertise their stock as their own strain are reliable inasmuch as they are students of breeding and are proud of their poultry progeny. Once the bird has left the breeder the strain as a strain should be lost.

One can never buy pullets and laying hens at 4s. to 6s. per pair from a good poultry farm. One can buy plenty of culls at that price anywhere, especially from dealers, who will tell you all about "an old man poultry farmer who is selling out owing to sickness." A good hen is worth 10s. 6d. to-day, and a pullet more. There are cockerels for sale at 5s. and 7s. 6d., but what student of poultry farming would be prepared to spend years of study in the industry, trapnest, single mate, and then feed cockerels to 10 months, in order to be a Good Samaritan by selling the product of his brains for 5s.? No one. Be prepared to pay from 21s. to 42s. for a good cockerel from a reliable breeder. You are buying his brains and it will be well worth the money. The same applies to chickens. Buy only from those advertising their own strain and are proud of it.

FEED.

It is not necessary to buy the most expensive feed, but buy the best of everything. By good management it is found that the simpler the feed the better the stock. We have cure-alls for sickness and spices for making birds lay an egg a day.

Such statements are ridiculous: it is necessary to give tonics at certain periods but not all the time. If it is necessary to tonic all the time look for bad management. Western Australia has an abundance of water, green-feed, wheat, meat and sunshine, and mixtures made from those ingredients will generally result in good production.

PLANT.

You must have efficient plant but do not let a salesman sell you something you do not want. Study will again prove that if you are going to build up a 1,000-head farm a 6,000-egg incubator is not wanted. Start smaller and learn by practical experience how to operate an incubator suiting your requirements.

Always realise that a brooder will never cover the number of chicks it is said to hold. Allow only 75 per cent. capacity.

Plenty of feed and water troughs so that all young stock can feed at one and the same time are necessary. With a shortage of food and water troughs the modest lady is always left—does not grow and is unprofitable.

Chaffcutters of all sizes can be purchased. It is little use obtaining one which takes an hour to cut up the feed for one hundred fowls. Obtain one which will do the cutting quickly when you have 1,000. The difference in cost is very little and saves time.

Having given a rough outline of the troubles of the newcomer into poultry farming, it is my idea to try and give ideas in order to smooth the path. You will have noticed that I do not like to buy a "going concern." To do that the purchaser must be well equipped with the knowledge of poultry farming. For any but the experienced, to purchase a going concern is surely looking for trouble.

The purchaser with knowledge of his subject goes into the business with his eyes open and can blame no one but himself. It is safe to say that 95 per cent. of those at present taking up poultry farming do not know their subject. Hence this article.

Having been given advice as to water possibilities, roads, markets, etc., we have now settled on a location which, for the sake of discussion, is fenced. Our first work is to draw out a plan of the block, showing north and south points in relation to boundaries. Mark the road, then select the place for the residence.

The nearest settler will give an idea about water, quality and depth. Try and locate the pumping plant on as high a level as possible. This assists the layout with gravitation.

Having settled on residence and water supply, place a fowl shed in position. This is a trouble maker. Your neighbour, no matter how little you consider he knows about poultry farming, can tell you from which direction the weather comes.

Sheds.

We have always been told that it is necessary to have the sun's rays in the furthermost parts of the fowl house, which means that the sheds should face east (in Western Australia), but some of the worst rains come into the front of a shed facing east. Rain in a shed means mouldy litter, and mouldy litter means trouble. One cannot face them north or south because of weather, so plan for a shed whose frontage is south-east. It receives very little storm rains in the front. It certainly gets wind, but wind is not such a bad thing. If the shed is intensive or semi-intensive they have depth and the wind is broken up before it reaches the hens. Most of the east winds will drive hard against the end of the shed. Anyway, we cannot have it good all the time, and wind is less trouble than rain. It is not necessary to have the sun's rays into the back of a modern well-ventilated cosy clean shed.

It will be understood that allowances must be made for different districts, but the same arrangements apply—always place the front of the shed in a position which lets least rain into it. Place the shed back and ends against the weather and not too close to the residence.

The extensive method of poultry farming includes all systems of raising stock which allow of free range for the birds. The intensive method includes all systems whereby the stock are confined to a limited space. Intensive poultry farming requires considerable skill in the management of the stock and it is not considered advisable for a beginner to embark on that system. Semi-intensive is a modified system whereby the birds have commodious housing but are allowed sufficient ground for exercise. It is the most popular form in Western Australia.

The semi-intensive shed is constructed in sections holding about 150 birds each, two sections being a self contained unit divided in the centre by a dry mash hopper. It should be 64 feet long by 16 feet deep, inside measurement, divided into two sections 32 feet wide, the roof 6ft. 6in. high back and 8ft. 6in. high front. This shed contains perches, nests, water supply and dry feed hoppers. A full shed would be four sections 32ft. x 16ft., making 128ft. long over all with yards in front 75ft. long. All sections are connected by doors inside at the front and have doors at back, and into each yard at one end of each section; the front door to be also the connecting gate to each yard. (A plan will be forwarded upon application.) The above shed will hold 600 birds divided into flocks of 150, and the only distance to walk in feeding is 128 feet there and back—a saving in "leg" power, time, and length of piping to have automatic water supplies to each section.

The perches at the back are hinged into the back wall so that all the perches can be lifted out of the way at one action. The nests are inside and 3ft. off the ground, eliminating backache in collecting eggs. The water is 3ft. high so that no sick fowl can contaminate the water supply. Place litter all over the floor except under the perches (board round these). This litter is the dining room, and it also keeps the eggs clean.

We place two of these long sheds on the plan, one in front of the other with 16 feet between the end of the yards and the back of the second shed.

Breeding Sheds.

Make provision for breeding sheds 8ft. x 5ft. with a small yard 16ft. x 32ft. conveniently situated and place the feed shed centrally situated between residence, laying sheds and breeding pens.

The egg packing room should be near the feed shed but not part of it, and the incubator room should be near the residence—you will find it convenient on a wet night when some trouble requires attention.

The plan is complete except for the green feed plot. This should be near the source of the water supply. It is here we need big pipes, and the cost of big pipes is heavy so do not have the plot too far away. The piping to the residence and laying sheds is of smaller diameter in comparison to that to the irrigation.

ERECTION.

Having laid out the farm on a piece of paper, decide on the method of erection.

If you have a sandy location I favour building with cement bricks. These are easily made and laid by a novice and cheap compared to wood and iron, look dignified when erected, and are very easy to keep free from pests. To those who wish to build in wood and iron or asbestos sheets the procedure is the same.

After the water supply is assured and the home (whether temporary or permanent) erected, start and erect one half of the long 128ft. shed, *i.e.*, 64 feet. This,

when completed, will house 300 birds after using it as a brooder shed. Leave the centre in such a state that it can be extended to 128 feet when you have the time.

Lucerne.

Dig up the lucerne plot, clean it well, lime heavily, and after three weeks dig in manure. Plant in rows two feet apart to allow of cultivation between rows. A good length of row is 80 feet. As lucerne when fed to fowls must be succulent, it needs top water and an irrigation system.

Irrigation.

When considering the irrigation plant, it is well to look ahead. Consult an irrigation specialist about water and how to obtain it. Different localities require different methods, but for this article we can assume that water is of sufficient quantity at easy depths to pump to the top of a tank standing on a stand 20 feet from the ground. Such a height will give sufficient pressure for a goodly number of sprinklers to be operated together.

From the source of supply run a 2in. pipe down the middle of the plot, which is 160ft. wide. At every 16 feet place a 2in. x 1in. cross for side branches 1in. diameter. Each branch contains five sprinklers on ¾ stands 3ft. high and are located 16 feet apart, the first sprinkler being 10 feet from the main. Each row has a 1in. stop cock to serve so that it can be used independently—use ¾ single butterfly sprinklers. The lucerne being planted in rows two feet apart allow of the sprinkler being midway between rows. Obtain advice for lucerne growing and follow it.

Water.

Have two outlets from the service tank, one feeding the lucerne plots, the other to the residence and fowlsheds. The outlet for the irrigation should be 18in. to 24in. higher inside the tank than the outlet for the residence so that if one forgets to turn off the water when irrigating, there is a reserve of 18in. to 24in. left in the tank.

Run the water right down to the fowl shed and inside to a trough fed by a ballcock. These ballcocks only cost from 6s. upwards and are a time saver.

When laying your pipe line look well ahead and put into position fittings necessary for future requirements. It is surprising how many you will desire and what a lot of future trouble will be saved.

Stocking.

We have now reached the time when we can consider stocking the farm. It will be essential to consider the requirements in brooders.

There are two popular systems—cold brooding and hot brooding. The writer favours the system of artificial heat, not because he condemns cold brooding but because it has been found the easiest and secures good results.

Should it be desired to "cold brooder" the chicks, purchase a reliable make. Makeshifts sometimes are successful but we are out to succeed by orthodox means.

Many and varied are the designs of hot air and hot water systems. All are efficient when used intelligently and all can be disastrous if neglected. Nevertheless, again obtain advice from a successful rearer of chicks and follow his practice until you understand his methods; you can then apply your own ideas with profit.

When stocking there are several procedures which can be adopted—(1) buying two year old hens just starting to moult; (2) day old chicks; (3) pullets 12 weeks old; and (4) purchasing fertile eggs and hatching them yourself. Do not consider No. 4, because our knowledge of poultry farming has not progressed that far in experience.

(1) What happens if two-year-old hens are bought? We must understand that these hens are just beginning a moult and will be in a moult for three to four months. They can be obtained cheaply but to the purchase price must be added the cost of feeding and the culling out of the indifferent hen. Those hens have passed their most profitable period else they would not be sold; they must be purchased direct from their breeder or you may have a dealer "telling you a story" and when you do get them they are only good for another year.

Since they are bought in February and March, they start to lay in June to August, right at the time you should be breeding chickens to take their place next year. Unless you are prepared to augment them with younger stock in the spring, I would advise you to leave two-year-old hens alone.

(2) Day-old chick purchases. This seems to be the most popular way of starting, but trouble might be bought also. Place the order and a deposit thereon with a reliable breeder in order to obtain the supplies when they are desired. Heavy breeds in July and August, light breeds in August and September. Brooder equipment must be ready and heated up for their reception. One runs the risk of deaths from lack of knowledge of feeding, etc.

(3) 12 weeks old pullets are about the best means of starting. No brooding equipment is required. All troublesome cockerels are non-existent, and the dangerous stage of rearing has passed, and last, but the most important, is that one obtains 100 pullets selected and culled right up to that age, at a price which is astoundingly cheap at about 3s. to 3s. 6d. per head. Place those pullets right into the sheds and most likely they have already been taught to perch.

The only work is to feed those pullets to maturity on a plain body-building ration. As this stage is so simple, I must revert to the purchase of day-old chicks as a starter. All cannot get 12-week pullets and chicks seem to be the most popular means of starting.

Having placed the order, purchased the brooders, plant and feed, we will now trace the period of growth up to laying stage, bringing into the picture the 12-week pullets when the day-olds have attained that age.

Chickens.

When the chicks arrive one can generally estimate they are ready for their first meal, which should consist of flaked oats and bran on a piece of brown paper until they start to pick up. Do not give water right upon their coming from the travelling crates. Wait until they have had some little food. Meatmeal in a ration for day-old chicks is a controversial subject. Sometimes I feel like advocating its omission, at others I must have it included. Until three weeks old the chick can thrive with or without it. To give it does not do any harm providing it is *carefully* regulated; but to overdo it is tragic. As we are building up our farm and studying at the same time, I am advocating its use from the start as we can carefully watch the results.

Feed the following rations:—Dry mash of equal parts wheatmeal and bran with a 5% of bulk meatmeal and 2½% of bonemeal—plenty of feeding room and you can with safety leave it before them all day long. Plenty of sand and litter on the floor of the brooder room keeps them amused and keeps down vices. At about 4 p.m. take away the mash and give cracked grain as an evening meal. Fine shell grit and charcoal should be in front of them always. After a week give them all the green feed (cut fine) that they can consume. Let in plenty of daylight and keep the shed as open as possible. The chicks must have fresh air—plenty of it—and unchecked daylight. Glass windows are no good. If the brooders are efficient no trouble should occur with an open shed. It should be the main idea to harden the chickens as soon as possible, but do not overdo it by allowing the chicks to get away

from the warmth until they know where it is to be found (about three days in an enclosure is sufficient), then let them travel as far as they desire. Keep them growing and start culling from the first hour.

Get away from that old style of grading the chicks according to size. Any who do not keep up to the average in growth should be killed. They make excellent "mock pigeon" pie after four weeks old. One must see "growth" in every action taken.

Do not cast slanderous terms on the little chick which goes to bed showing a crop like a large marble, rather encourage it. You are learning the first lesson on feeding, *i.e.*, "put into the birds what *you* want, not what they want."

Keep a good lookout for chills, the most prevalent and dangerous ailment to baby chicks. It is mostly caused through overcrowding; that is why only 75 per cent. brooder space is advocated. If the temperature is right the chicks spread out and do not crowd when under the brooder. Keep reducing the heat as they get older. At about 8 weeks you can give them in the morning a plain wet mash of 8 parts green, 5 bran, 3 parts wheatmeal, ½ meatmeal, and ¼ bonemeal. Keep the dry mash before them all day, and whole grain at night (fed in the litter on the floor shed), keep culling and keep making growth.

They pass to 12 weeks old and all the cockerels are in pens by themselves. Unless these cockerels are of special strain, feed for flesh and market as soon as possible. (Exit cockerels.)

At about 16 weeks old the pullets are doing fine, all are feathered and quite plump. Keep them growing—let them have all the open space they can. Cut down the meat meal and add a little more bran. Personal observation added to all the knowledge you should have learned by continuous reading, will tell you how things are going along. Plenty of green feed should be given after grain at night also. Keep going round the sheds at night handling the birds. They get to know you, like it and so you progress to that most interesting stage when the combs start to grow apace. You now get the nests ready.

Nests.

Nests should be inside the shed so that we keep the eggs clean, and collect under cover. Three feet from the ground and no backaches. Put in trap nests. Although not essential, trap nests are the only accurate means of telling what each pullet does and how she does it. Cull a pullet which lays a misshapen egg. One that lays a blood spot in the egg is easily detected and trap nests do not cost much money. They can be made for one shilling each and are self-acting. Each pullet, on laying, is banded with a celluloid band embossed with a number, a red band this year, white next year, blue following. You can always tell the age without trouble.

Keep them growing. The continuous study and handling informs you whether a bird is putting on growth. If she is not, market her for she will be unprofitable, and do not put the pullets on to a layer's ration just because they start to lay.

Feeding a Pullet for Eggs and Growth.

A pullet is born into the world with the one object of reproducing her species. That object being a most exacting practice needs stamina and vitality in order to attain its achievement.

One should aim for eggs and body. Do not try for eggs only and thereby cause a breakdown. There is quite enough trouble without helping it along. Keep that pullet on a grower's ration:—8 green, 5 bran, 3 wheatmeal, ½ meatmeal, ¼ bonemeal, 1 oilcake (damp measure). Dry mash all day and wheat at night followed by green feed. A large quantity of eggs will be obtained on the above ration,

but best of all, growth is obtained along with eggs. A laying ration is a forcing ration, and although you will get 10 more eggs per year the constitution of the pullet is broken down and she is of little use as a reproducer of her species. Keep her growing.

It will be noticed that I am an advocate of a dry mash hopper in front of the stock all day. Many will say that the birds get fat. Any who say that have forgotten my statement—"Put into the birds what you want, not what they want." If an egg-forming ration is in that hopper those birds cannot receive a fattening ration. But there is also another reason to explain which you must recall that statement found in every book on elementary poultry—"The average ration for a bird is 4 oz. per day of dry matter." In discussing this we must take several matters together—egg laying, wet mashes, green feed and trap nesting—to explain our point.

When analysing that statement of 4 oz., it must be understood that it also means an average producer and, as the average production is around 130 eggs, and as "*you put into the bird what you want,* etc." how can a producer of 230 eggs lay that number if you only give her an average ration?

A 4-gallon kerosene tin will hold about 50 to 60 ration of wet mash for your stock. One can assume that the birds are intelligent enough to know that they can get no more until the grain feed in the afternoon and so they eat all they can, both the small producer and the high producer. The small producer cannot use all the egg-forming ration to advantage so it is lost. The large producer does not get enough. Now place in front of the same birds a dry mash hopper and study the trap nests. It will be found first of all that the kerosene tin will feed *100 rations* in the morning and all will be content. When registering the trap nests and watching the birds when released you find the solution to feeding the high producer.

When released from the trap nest, the high producer rushes (no other word for it) to the hopper, while the low producer casually goes outside the shed, finds a convenient hole and settles down, which proves that the high producer must get more feed than the low producer, and that a kerosene tin to 100 is sufficient feed for a low producer.

When feeding at night all will leave the hopper to partake of the grain.

Four ozs. of dry matter also means 2 ozs. of a mixture of bran, pollard or of wheatmeal, meatmeal, oilcakes, bonemeal at morning and 2 ozs. of wheat at evening.

Measure out 2 ozs. of mash mixture and place it in a well developed crop and see how little space is occupied. The crop is about half full and anything half full is hungry, and as a hungry bird is not contented fill it up with a bulk (greenfeed) which, besides filling the crop, aids digestion.

Weigh out 2 ozs. of wheat and the same thing occurs—the bird would go to bed hungry—therefore fill the crop with greenfeed fed after the wheat. Beside filling the crop it again aids digestion. Do not feed more than 2 ozs. wheat with that 2 ozs. mash.

The feeding must be studied in a careful manner. We may certainly give the birds "as much mash as they will clean up in 20 minutes" and we hand out the wheat as if it does not cost anything.

We know what is meant by a balanced ration (1 part protein to 4.5-5 parts carbohydrates). The mash is mostly the protein portion and the wheat the carbohydrates.

Let me explain how lack of study in feeding causes disastrous results. It is common in the industry for the attendant to be tired just when the evening meal is due. He knows his own tea is ready for him and so the fowls are given their wheat by throwing down the predetermined quantity and the attendant retires to his own meal. This is quite satisfactory for a while, when suddenly the birds will not eat

their morning mash. The surplus is collected and fed to cockerels and ducks, etc. That evening the fowls are again thrown their evening grain ration and left. Again the next morning less mash is eaten until it is most marked that the birds are going off the lay. The farmer consults his next door neighbour, accepts all sorts of advice and finally giving up in despair goes to a successful farmer or an adviser with his troubles. He is then told that his birds are overfat or starved and an analysis of his actions brings home to him that he has carefully studied rule of thumb methods and has not applied common sense.

Let us analyse the proper procedure. Birds, like men, are inconsistent eaters. At times they feel indifferent to feed and we have thrown to them their predetermined ration of wheat. The birds this evening leave half the wheat, but in the morning before the attendant is awake, the birds are down from the perch and consume the remainder, making their crop half full before mash time. The same thing repeats itself daily until disaster follows. The birds are getting little mash (protein) and more than sufficient wheat (carbohydrates and fats). Their ration becomes unbalanced, and when unbalanced in such a way the birds are not receiving sufficient protein but more than is necessary of carbohydrates and fats. Hence they get fat and go off the lay.

The intelligent man feeds his wheat earlier and watches the approach of the birds. If they are ravenous he gives them 90 per cent. of their ration. If they are sluggish to the approach he only gives them 10 per cent., so that in the morning they are ready for the mash, but he does not give them the full ration of mash. Only 75 per cent. of it in order that the stock desire more wheat that evening. Balance the quantities of wheat and mash that the proportions of protein to carbohydrates and fats are as near as possible balanced as 1 of protein to 4.5 or 5 of carbohydrates.

At the same time see that their crops are full at evening meal by feeding as much green feed as the crop will hold after they have partaken of their desires in wheat, but never feed more than 2 ozs. of wheat at night.

It is very easy to see if the stock are feeding correctly. How many forget to balance the quantity of feed consumed over a period with the number of birds fed. For example, 450 average birds consuming 4 ozs. per day of wheat, bran, pollard, meatmeal, etc., should consume 1 cwt. of feed per day or 7 cwt. per week apart from greenfeed. Quite easy to work out, but it does give an idea of how the birds are eating.

It must be understood that when **culling heavily under trap nests** the consumption is higher because the birds are then above the average.

In this discussion we have considered all things with mathematical precision. We must, of course, while keeping balances in mind, use initiative in application. Experience by keen observation, makes the figures look false, but they are the best that can be done in order to explain the procedure. Condition of the flock, egg production, and the last but most important factor, colour of faeces or droppings, must be studied closely. The colour is the best guide as to a balanced ration, no matter how mathematically correct the figures may be. It is here that the successful poultry farmer discovers his faults in feeding, and it is from here that he adjusts his ration, and adjust it he must, almost weekly, no matter how close he has worked to figures.

The colour of the faeces should be "black-brown" tinged with a white smear. If it gets lighter in shade to a mustard colour the birds are receiving too much fat-forming material and not enough protein. We are not discussing the colour which denotes sickness in its common application, but only feeding defects.

The birds are about to start laying at this period. In the December issue the feeding of laying stock and its subsequent results on the birds' condition will be studied.

MALTING BARLEY.

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During recent months a certain amount of attention has been devoted to the possibilities of increasing the quantities of malting barley grown in this State. As will be seen from Tables 1 and 2, the amount of malting barley of satisfactory quality grown in past years has been insufficient to meet local requirements.

Table 1.—IMPORTS OF BARLEY INTO WESTERN AUSTRALIA.

Season ending 30th June, 1934.

1928–29.	1929–30.	1930–31.	1931–32.	1932–33.
centals.	centals.	centals.	centals.	centals.
2,610	267	77	30	28,450

Table 2.—IMPORTS OF MALT INTO WESTERN AUSTRALIA.

1928–29	1929–30.	1930–31.	1931–32.	1932–33.
centals.	centals.	centals.	centals.	centals.
15,566	37,615	16,610	14,505	26,415

This shortage is largely the result of the policy of the local maltsters, who aim to maintain a small deficiency so that all the local barley of satisfactory quality may be absorbed by the home market. The maltsters estimate their requirements a year ahead, then supply seed to growers and make arrangements with them concerning the disposal of the subsequent crop if it proves to be of satisfactory malting quality.

In 1932-33 the Council of Industries (which has since ceased to exist) undertook publicity work in connection with the stimulation of malting barley growing. The objects were to demonstrate that really good quality malting barley could be grown in Western Australia, and to increase the available supplies in order to meet an anticipated increase in the local demand, and also, if possible, to build up a small export trade. A series of trials was initiated and carried out in 1933. Briefly, the arrangement was that the Council made available to a certain number of farmers throughout the State a small quantity of good quality seed of the variety "Pryor," that being the most commonly grown variety for malting purposes. The farmer planted this and furnished details of manuring, cultivation, etc., to the Council. If the barley was of satisfactory malting quality the farmer was then able to sell to the Council at a price previously fixed; last year this was 3s. to 3s. 2d. per bushel f.o.r., Perth. The Council in turn disposed of the barley to the maltsters.

The results of these trials, although in some respects inconclusive, showed that malting barley of a quality quite the equal of the best South Australian barleys could be grown in a number of districts in Western Australia, but that it was essential that care should be exercised in the choice of district, soil, cultural methods and harvesting, and that "hasten slowly" was an excellent motto for farmers to adopt when considering the growing of this crop.

In view of the possibility of some farmers turning to barley growing as likely to be a less unprofitable line of production than wheat, this article has been written in order to give a brief account of the position of barley in world trade, and also some account of its present position in Western Australia.

Barley is the hardiest of the cereal crops and has been cultivated since ancient times. It was then a staple article of human diet but now its uses are confined

to its value as a food for livestock and its use in the malting and distilling industry.

It thrives best in regions of moderate temperature and not excessive rainfall. It is a shallow feeder and gives best results in rich, porous, well-drained soil.

It is grown almost solely for its grain, the straw, although suitable for feeding to stock, having little saleable value. The better grown samples are greatly in demand for conversion into brewing malts and, in consequence, command a higher level of prices than ordinary feed barleys. No cereal is more carefully grown and harvested than the best barleys, and considerable judgment is exercised by buyers of malting barleys.

Feed barleys enter into direct price competition with wheat, oats, maize, and other common stock feeds.

Prior to the War, world production of barley amounted to about one-third the production of wheat, Russia being by far the largest producer.

Since the War, world trade in barley has been decreasing in volume, due to a definite decrease in consumption in the chief importing countries, notably the United Kingdom and Germany; from five million tons in the period 1909-1913 it has declined to three and three-quarter million tons in 1926-1930. This has led to some accumulation of surplus stocks despite the fact that there has been a reduction of acreage in exporting countries as compared with pre-war years. Just at present, however, due to drought in overseas countries, the demand for barley is increasing and prices are rising.

The chief exporting countries are now Roumania, Argentina, and Russia in that order, and the chief importing countries the United Kingdom and the Netherlands, followed by France and Germany.

The two main types of barley are two-row barleys and six-row barleys. Grain of the latter type can be distinguished by its rather bent or twisted kernels, as compared with the straight and more plump grains of the two-row varieties. The best known local examples of these two classes are the varieties "Pryor" and "Cape."

With the exception of the best types of Californian barley, six-row barleys are but little used in the brewing trade outside North America, though in the latter region they have always been preferred to the exclusion of the two-row type. The reason for this difference in preference is rather difficult to arrive at. Australian brewing practice, though built up on English lines, now follows continental ideas, and only two-row barleys are used.

The buying of malting barley is done by men who, as a rule, have had years of experience in the business. In England home-grown barley, and the better portion of the Californian crop, are sold on sample; the remainder of the Californian crop is sold as "standard" or "superior to standard," while all other malting barleys are sold on monthly F.A.Q. samples obtained under the supervision of the London Corn Trade Association.

Barley used for distilling—as distinct from malting—can be described as carefully selected feeding barley of high germination, though a good feed barley is not necessarily suitable for distilling. The quality is lower than that required for malting purposes and a high nitrogen content is necessary in a distilling barley.

The maltster has very definite ideas as to the characteristics of a good malting barley and these requirements must be kept clearly in mind by the grower.

As the malting process consists of allowing the barley grain to germinate under suitable conditions, then arresting the growth after a short period, during which certain chemical changes have occurred within the grain, it is obvious that high germinating capacity is essential. Anything which tends to retard or reduce germinating capacity correspondingly reduces the value of the barley. Uniformity

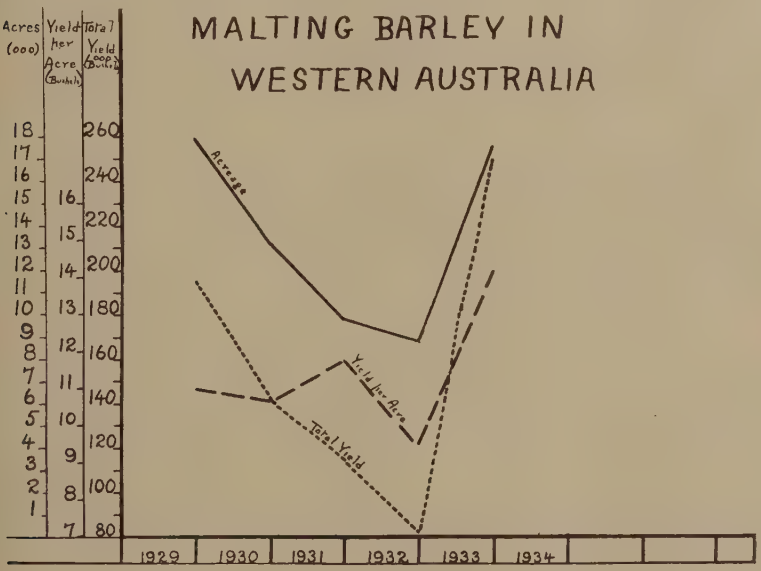
and evenness of germination are also essential. Such factors as uneven size of grain, broken kernels or damage to the skin or husk must all be taken into account when assessing the malting value of a sample.

The grain itself should be plump, even, thin-skinned and have a bright appearance. A sample containing an appreciable quantity of small, pinched grain is unsuitable for malting purposes.

The barley must be reasonably free from smut, weed seeds, chaff, foreign grains and other impurities.

The most important single factor in determining the malting quality of a sample is the nitrogen content of the grain. A high nitrogen content is not desired; up to 1.5-1.6 per cent. is not objected to, but anything above that is regarded as high and the value of the barley for malting purposes is reduced accordingly. Fortunately for buyers the nitrogen content of the grain is fairly closely correlated with appearance, particularly with the internal appearance of the grain. If, on cutting with a sharp knife or razor blade, the grain proves to be white and mealy, it usually follows that the nitrogen content will be satisfactorily low and the carbohydrate content correspondingly high. If, on the other hand, the grain has the flinty, transparent appearance of a good quality wheat, it is safe to assume that the nitrogen content will be high and the grain will have a correspondingly reduced value for malting purposes.

The statistics relating to acreage, yield per acre and total yield of malting barley in Western Australia are given in Figure 1.



The acreage and total yield declined steadily from 1929-30 to 1932-33. In 1933-34 the acreage rose suddenly, and, as the yield per acre was considerably above that for any of the previous four years, the total production was comparatively high. The reason for the increased acreage in 1933-34 has already been explained.

The best quality malting barley is received from the districts of Toodyay, Moora, Victoria Plains and Dumbleyung, and it is from these centres that most of the local supplies are drawn. The average rainfall for the conventional growing period (May to October) is between 12 inches and 16 inches (Fig. 2). The soils are mainly those of the brown earth type (1).

Environment is the major factor which influences the malting quality of a barley sample. Generally speaking a district which produces good quality wheats will not produce a good sample of malting barley. A relatively hot dry ripening period favours the accumulation of nitrogen in the grain and this leads to high quality in wheat, but, from the maltster's point of view, poor quality in barley. For this reason the heavier forest country of the Eastern wheatbelt is definitely unsuitable for the production of the latter crop. Fair quality crops are sometimes grown on the lighter types of soil in districts with a growing period rainfall under 12 inches, but it is found that the best results are obtained from light to medium textured soils in districts with a growing period rainfall of from 12 inches to 15 inches. The heavier more fertile soils will give the biggest yields, but the risk of producing a poor malting sample is much greater than on the lighter sandier soils.

[1] Prescott: The Soils of Australia in Relation to Vegetation and Climate.

The effect of environment on quality is well illustrated by the results of trials last year at the Wongan Hills Light Lands Farm and the Merredin Experiment Farm. "Cape," "Pryor," some Californian six-row barleys and several types of the best English malting barleys were grown at both farms.

At Wongan Hills the soil is of the lateritic sandplain type characteristic of large areas of the wheat belt. It is deficient in plant food, particularly nitrogen and phosphates. The barley was sown during May on fallowed ground and superphosphate (22 per cent. P_2O_5) applied at the rate of 120 lbs. per acre. The rainfall during the growing period last year was 12.6 inches.

At Merredin the soil is a brown clay loam, with a calcareous sub-soil, typical of the heavier forest soils of the Eastern Wheat Belt. With the exception of phosphates it is relatively well supplied with plant food. Studies have here shown that, during a period of summer fallow, there is a building up of available nitrates in the soil.† This is important from the point of view of barley quality. The barley was planted during May on fallowed ground together with 112 lbs. of superphosphate per acre. The rainfall for the growing period was 7.84 inches.

Owing to the late opening of the season, no germination took place at either farm until the end of May.

Germination percentages and analyses for moisture and nitrogen and 1,000 grain weight of the samples taken at each farm are given in the following table:—

TABLE 3.—ANALYSIS OF BARLEY SAMPLES GROWN AT MERREDIN AND WONGAN HILLS.

——	Identification No.	Percentage Germination.	1,000 grain weight (grammes).	Moisture.	Nitrogen.
Sample from Merredin Experiment Farm.				%	%
1. Californian Brewing H. 42 ...	M1	95	34·2	10·3	2·3
2. Best Californian Brewing ...	M2	99	36·4	10·3	2·1
3. Cape	M3	*96	36·4	10·7	2·3
4. Plumage Archer Chevalier type	M4	96	38·8	10·3	3·0
5. Plumage Archer (1924) ...	M5	99	40·4	11·1	2·9
6. Plumage Archer No. 2 ...	M6	98	39·8	10·3	3·0
7. Plumage Archer, Type HCL 477	M7	98	39·8	10·1	3·1
8. Pryor	M8	100	41·8	10·2	2·1
Samples from Wongan Hills Light Lands Farm.					
1. Californian Brewing H. 42 ...	W1	93	47·0	10·3	1·6
2. Best Californian Brewing ...	W2	99	48·8	11·1	1·5
3. Cape	W3	*68	49·8	9·8	1·4
4. Plumage Archer Chevalier type	W4	99	43·0	10·3	1·9
5. Plumage Archer (1924) ...	W5	99	43·8	10·3	1·6
6. Plumage Archer No. 2 ...	W6	100	42·2	10·4	1·5
7. Plumage Archer, Type HCL477	W7	100	39·4	9·9	1·5
8. Pryer	W8	*88	45·4	10·4	1·3

* Somewhat mouldy and slow rate of germination—grain probably rather immature when harvested.

The most striking difference between the samples from the two districts is in nitrogen content. In some cases it is twice as high for the same variety at Merredin as at Wongan Hills. This was reflected in the appearance of the samples, those from Merredin being rather small and pinched, and appearing

† Teakle and Burvill: Fallowing for Fertility; W.A. Journal of Agriculture, Vol. 7, p. 119.

hard and flinty when cut. Those from Wongan Hills were paler in colour, plumper, had a starchy appearance when cut and gave the impression of being of fairly good malting quality.

The samples were forwarded to the London firm of Messrs. W. Watson & Co., from whom most of the seed was originally obtained through the courtesy of Mr. K. Edwards, of the York Roller Flour Mills. The agents submitted them to several malsters, who expressed the opinion that, while the Merredin samples were definitely unsuitable on account of their steely character, grain similar to that grown at Wongan Hills would practically all be suitable for malting purposes. Of these it was considered that the Californian six-row types would be the most saleable.

This latter remark is of considerable interest as the prospects of exporting the two-row types at a profitable price do not appear bright. Speaking of Australian production, when discussing the possibilities of Empire countries supplying a larger proportion of English requirements, Professor Clark Grant* says: "No doubt more barley could be produced and the quality of export shipments of malting barley be improved by better seed and better harvesting methods. It is doubtful, however, if the existing demand for malting barley of this kind in the United Kingdom would remunerate the Australian producer for the extra cost and effort involved in attempting to gain a greater share in a market already supplied."

There does appear to be some prospect, however, of a market being found in England for the best samples of the six-row "Cape" type at a more remunerative price owing to its higher yielding capacity under local conditions as compared with "Pryor." For a long period Californian sun-ripened six-row barleys have enjoyed a favoured position with the English maltster. A certain percentage of such barley is necessary for the production of the light sparkling bottled beer at present in demand, and, so far, California has been the sole source of supply. There is now a tariff preference in England for Empire-grown barleys and, in addition, the Californian product will now have a wider home market to enjoy and, consequently, there will be less available for export at the old level of prices. As, climatically, we should be well situated to produce a barley similar to the Californian article, it is likely that a market could be found in England for some of our six-row "Cape" barley, provided that the requirements of the maltster are met as regards plumpness, uniformity, low nitrogen content, and freedom from harvest damage.

As previously mentioned, the English agents to whom the samples were sent are emphatic that there is a much better prospect for marketing a barley of this type in England than attempting to push the export of the two-row varieties in a market which, up to the present, has been over-supplied with high quality grain of the two-row type.

The cultural requirements for barley are very similar to those for wheat. Seed should be sown at the rate of about 45 lbs. per acre. Well drained soil should be chosen as barley will not stand wet feet. In the recognised wheat districts the grain should be planted late in April, or early in May, and superphosphate applied at a rate similar to that for wheat. It is advisable to pickle the seed as a preventive to loose and covered smut.†

It is necessary to take the utmost care when harvesting to ensure that the grain suffers the minimum amount of damage in the process of threshing. No matter how good the quality of the grain it will be rendered useless to the maltster if it has been skinned and cracked when harvested.

* Grant: Barley Survey: E.M.B. publication. No. 62.

† Barley Smuts and their Control, Leaflet No. 375, W.A. Dept. of Agriculture.

Partial skinning makes for uneven germination and it is better that some of the awn should be left on the grain rather than have the threshing so severe that it damages the skin.

If the grain is not to be unduly damaged, it is necessary to give more space between the beaters and concave than is usually the case for wheat, and, if necessary, reduce the pace of the machinery. It is essential that the grain should not be allowed to repeat through the peg drum. However, the actual adjustments necessary to the different types of harvesting machinery can only be determined at the time by the farmer himself after observing the character of the work being done.

In conclusion, it must be emphasised that farmers who are considering growing malting barley should proceed with caution. It is first necessary to decide whether the district and soil is suitable for the production of the crop, then to consult the local maltster to ascertain the prospects for the future disposal of the grain, if it is of suitable malting quality. Close attention must be given to time of planting, seed treatment for disease, and particularly to harvesting. It should also be realised that high yields and first-class quality seldom go together and that, particularly in dry seasons, the best quality grain will be obtained from the lighter soils. Despite all precautions, however, seasonal influences may result in an inferior malting sample, and for this reason it is wise to look upon the growing of malting barley as a side-line, rather than to have it as the main crop.

The prices paid by the local maltsters for malting barley for the past five years are shown in the following table:—

Table 4.—BARLEY PRICES (F.O.R. PERTH) PAID BY THE MALTSTER FOR THE PERIOD 1929–1933.

	1929–30.	1930–31.	1931–32.	1932–33.	1933–34.
Price per bushel—	s. d.	s. d.	s. d.	s. d.	s. d.
Top	4 3	3 0	3 0	3 3	3 3
Average	3 11½	2 11	2 11	3 2	3 2

For export purposes "Cape" or "Californian" six-row barley should be more remunerative than "Pryor" on account of superior yielding capacity. If a farmer has a plump, mealy, well-harvested sample of one of these varieties there should be little difficulty in his arranging for the export of a trial parcel to England.

The writer wishes to acknowledge his indebtedness to Mr. L. Barrett, of Union Maltings Ltd., for much helpful criticism and advice, and also to Mr. K. Edwards, of the York Roller Flour Milling Coy., who made available samples of different varieties and later forwarded these to England for report by Messrs. W. Watson & Coy.

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THE DETERMINATION OF AGE IN THE HORSE.

By A. SHILKIN, B.V.Sc., Department of Agriculture.

For all practical purposes the indications as to the age of a horse are furnished mainly by its teeth and more particularly the lower row of front or incisor teeth.

As in humans, the horse has two dentitions, namely, first a temporary dentition in which the milk or foal teeth are present and secondly the permanent dentition, which replaces the former.

The milk incisors or nippers differ from the permanent ones by being shorter and whiter, having their outer surface smooth, while that of the other generally has a slight vertical groove; and from the fact that the milk incisors gradually become shorter and shorter as soon as they come into wear: the opposite being the case with the permanent ones.

A short resumé of the numbers and types of teeth in the adult will no doubt be advantageous before giving an account of the eruption ages.

The incisors are the nipping or biting teeth, situated at the entrance of the mouth. These are six in number for each jaw. The two front incisors are termed *centrals*; the next *laterals*; and the two farthest back the *corners*.

The molars form four ranks, two for the lower and two for the upper jaw. These are grinding teeth and in the mature animal there are six in each rank and they are separated from the incisors by a space known as the interdental space. In this space, the canine teeth, tushes or tusks are found in males only.

In determining the age of a horse the molar teeth are usually disregarded and reliance placed mainly on the incisors. The eruption ages of these, which are necessarily approximate, are as follows:—

At *birth* the two central incisors are present.

At *9 weeks* the two lateral incisors are present.

At *9 months* the two corner incisors are present.

The first and second temporary molars are present at birth or soon after and the third appears at about three months. At *2 years* the horse has a well developed full temporary mouth and may be mistaken for a five-year-old. The teeth usually come into wear three to four months after eruption, depending on the type of feed, country, etc.

At *two and a half years* the central milk incisors are shed and replaced by permanent teeth.

At *three and a half years* the lateral milk incisors are replaced by the permanent teeth and

At *four and a half years* the permanent corner incisors appear.

In the males, the canine teeth, which are permanent, appear at between four and five years.

Up to 5 years the age can be told with a considerable degree of accuracy. After this, guidance as to age up to 8 years is obtained from the disappearance of the infundibulum cup or black mark on the tables of the lower incisor teeth.

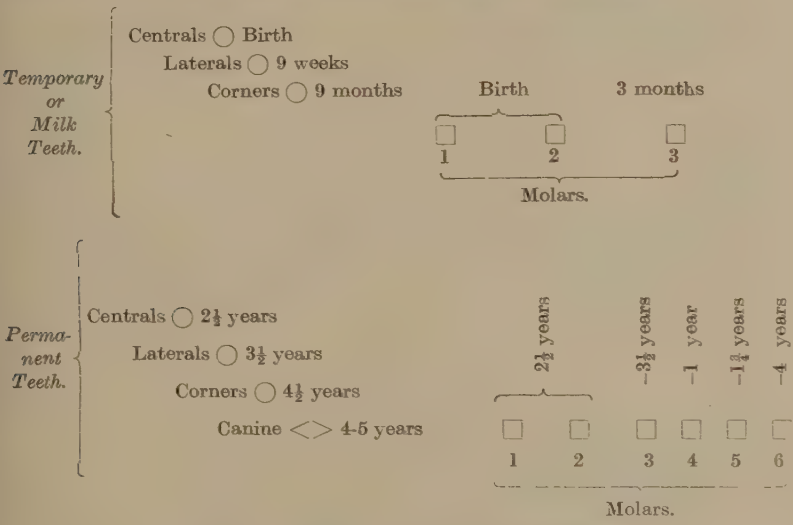
At *6 years* the infundibulum disappears from the lower centrals.

At *7 years* the infundibulum disappears from the lower laterals.

At *8 years* the infundibulum disappears from the lower corners.

After 8 years the ageing is purely a matter of experience and judgment. As the horse ages the teeth become longer and nearer the horizontal, the oval table surface gradually becomes triangular and smaller and the gums recede. The black mark in old teeth is really the pulp cavity coming upwards and is distinguished from the infundibulum or cup previously mentioned by the fact that it has no enamel round it.

The eruption ages of the teeth can thus be represented diagrammatically and a constant mental picture of this is a helpful factor in determination of ages. The eruption ages of the molar teeth are included here for completeness.



The above represents one side of the lower jaw.

In Australia horses are aged from the 1st August so that in ageing a young horse, the actual date of whose birth is unknown, in case of doubt, he should be assigned the younger of the two ages if his "class" birthday be near at hand, the older of the two if it be recently passed. Thus suppose a horse had a "full mouth" (all his teeth permanent) in June, but his corner incisors showed little or no wear, he should then be aged as a 4 year old and 2 months later would become a 5 year old. At the worst we could here be only a couple of months out, but if he was aged as 5 years, at least 9 or 10 months would be added to his age.

The term "rising" is, as a rule, applied to a horse's age when it is less than that which is stated and "off" when it is more. Thus a horse "rising five" is a 4 year old which is nearer 5 than 4. An animal "4 off" is a 4 year old nearer 4 than 5.

In conclusion, it may be stated again that experience is the essential element in the ageing of a horse and practice should be obtained as often as possible.

Fig. 1.—One year.

Fig. 2.—Two years.

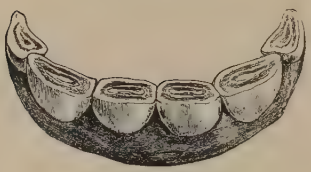


Fig. 3.—Three years.

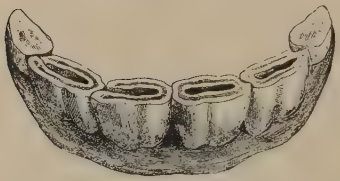


Fig. 4.—Four years.

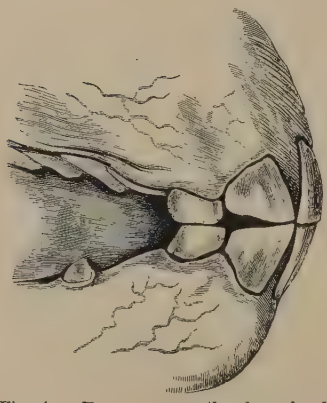


Fig. 4a.—Four year mouth when closed.

Fig. 5.—Five years.

Fig. 6.—Six years.

Fig. 7.—Seven years.

Fig. 7a.—Seven year mouth when closed.

Fig. 8.—Eight years.

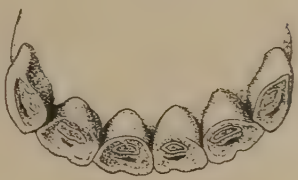


Fig. 10.—Ten years.

Fig. 9.—Nine years.

Fig. 11.—Eleven or twelve years.

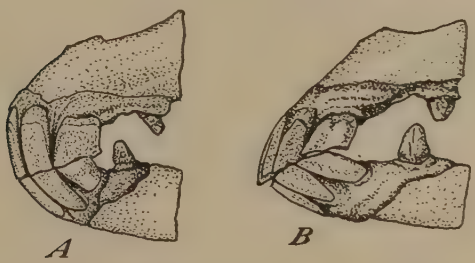


Fig. 12.—Comparison of incisors and rushes at—A, 7 years; B, 20 years

DAIRYING SHIELD FOR LEADING DISTRICT IN DAIRY FARM COMPETITION.

G. K. BARON-HAY,
Superintendent of Dairying.

The Dairying Shield which was presented by Cuming, Smith & Mt. Lyell Farmers' Fertilisers, Ltd., to be won by the district containing the four leading dairy farms entered for the Better Dairying Competition was won in 1933-34 by Zone No. 1, embracing the district from Armadale to Brunswick.

The four farmers who were responsible for their district winning the shield are:—

Messrs. S. F. Russell, Serpentine.
W. Shaw, Harvey.
G. E. Scott, Yarloop.
S. Bowers, Brunswick.

Reference to Table 1 below, which gives the particulars of stock on the four leading farms in each Zone, will show the very high average production of the cows on the four leading farms in the winning Zone, namely, 313.6 lb. butter fat per cow. Two of the farmers—Messrs. S. F. Russell and S. Bowers—were leaders in their respective Herd Recording Associations, while a third—Mr. G. E. Scott, Yarloop—was the owner of the leading herd in the Pure Breeds Herd Recording Scheme.

Table 1.

Particulars of Stock on the Four Leading Farms in Each Zone.

	Av. Butter Fat per Cow.	Av. Butter Fat per Acre.	No. Acres per Cow.	Av. Pigs per Farm.
Zone 1—Harvey ..	313.6	71.9	4.36	*8
Zone 2—Bunbury ..	236.5	44.9	5.27	52
Zone 3—Bridgetown ..	244.0	45.0	5.40	19
Zone 4—Manjimup ..	197.5	40.5	4.90	12
Zone 5—Busselton ..	207.7	50.0	4.20	39
Zone 7—Denmark ..	207.3	70.0	3.00	33

* Whole milk district.

The average butter fat per acre was 72 lb. in the winning Zone, which is considerably higher than that in other districts, except Zone 7, Denmark. However, in Denmark, areas cleared on each farm are small, and the herds are not yet developed fully. In other districts the average production per acre was approximately the same as the average on all farms in the competition, *i.e.*, 43 lb. per acre.

It also will be seen in Table 1 that in the winning Zone the number of pigs per farm is low. This is explained by the fact that many competitors in this area are suppliers of whole milk, and the four leading farmers supply a quantity of whole milk during the year.

In Zone 2, Bunbury, the number of pigs per farm is high and, on all older developed dairy farms, it is noticed that more attention is paid to pig-raising than on newer areas. It also indicates that in this district farmers did not sell their sows during the period 1931-32 when the prices of pig products were low.

In the extreme southerly districts of this State the number of sows on farms at the end of 1933 was approximately half what they were two years previously.

Table 2.

Conservation of Fodder on Four Leading Farms in Each Zone.

	Average Acres per Farm.	Hay per cow.	Silage per cow.	Summer Fodder Acres per cow.	Irrigated Pasture. Acres per cow.
		Tons.	Tons.		
Zone 1—Harvey ..	132	1.52	0.3	0.3	1.2
Zone 2—Bunbury ..	167	2.00	0.6	0.1	0.04
Zone 3—Bridgetown ..	113	2.60	1.1	0.14	—
Zone 4—Manjimup ..	141	1.60	0.6	—	0.33
Zone 5—Busselton ..	94	2.30	2.5	0.16	—
Zone 7—Denmark ..	55	1.20	1.2	1.1	—

Table 2 shows that in the winning Zone 1, special attention has been paid to the conservation of fodder, the growing of summer crops and the provision of green feed generally during the summer months. Although the production of hay is one-half ton per cow below that of the Bunbury Zone, this is more than offset by three times the area of green summer crops being provided, and no less than 1¼ acres of irrigated pasture per cow. This ample provision of succulent feed throughout the year accounts in great measure for the average high production of cows in the four leading herds.

The competition was won last year by Zone 2 (Bunbury), and from the improvement noticed in all areas during the three years that the competition has been conducted, both the previous winners will have to make special efforts in order to retain the Dairying Shield which is to be competed for over a maximum of five years.

FEEDING FOR FAT LAMB AND MUTTON PRODUCTION.

(Published by courtesy of the Australian Broadcasting Commission, being an Education Talk given through Station 6WF on 6th April, 1934.)

By DR. E. J. UNDERWOOD,
Animal Nutrition Officer, Department of Agriculture.

There is probably no branch of the sheep industry which can furnish such quick and profitable returns as that of fat lamb raising. More skill and care is required than is usually bestowed on the average merino flock, but the profits obtainable from the right type of lamb produced at the right time are likely to be greater than those from even the most profitable wool types. Under the climatic conditions of the southern portion of this State, fat lamb raising has the further great advantage of enabling the maximum number of stock to be carried in the winter period when feed is most abundant, and a minimum number in the summer when the feed is driest and scantiest.

The first essential in the profitable production of fat lambs is undoubtedly the selection of the most suitable breed of ewe and of ram for mating. The pure merino is quite unsuited for this purpose, as the lamb is slow maturing and of poor shape and quality of carcase. Experiments at the Avondale State Farm and elsewhere have established the fact that the best quality lamb is produced by mating one of the Downs breed of rams with the Merino-Longwool cross-bred ewe. In this State the most profitable returns have usually been obtained by using a Southdown ram on the Merino-Border Leicester ewe. First quality lambs, however, may be produced by using either a Shropshire or a Dorset Horn in place of the Southdown ram, and a Lincoln or English Leicester in place of the Border Leicester ram.

Having decided on his breeding programme, the farmer has two principal aims:—

1. To obtain the maximum "drop," *i.e.*, percentage of lambs from his ewes.
2. To obtain the maximum growth rate from these lambs so as to have them at a marketable size and quality as early as possible.

While **breed** is of outstanding importance in both these considerations, **feed** is also capable of exerting a profound influence both on the number and the quality of the lambs produced. Poor feeding may completely nullify the effects of good breeding, while good feeding may greatly enhance the value of even the best breeding.

The influence of feeding on lamb and mutton production is best discussed under two headings:—

1. The influence on breeding.
2. The influence on growth.

1.—Breeding.

The fertility of a female animal depends primarily upon her ability to produce fully mature ripened eggs or "ova," capable of fertilisation by the sperms of the male. If the animal is undernourished, i.e., receiving too little total food, the ova do not ripen properly, and may even degenerate and atrophy even when almost mature. Some degree of degeneration of the ova in the ovary is a normal process, whatever the state of nutrition of the animal, but if the animal is kept in very poor condition, then this degeneration takes place on a consider-

able scale and results in the animal being sterile for the season or at least having its prolificacy reduced.

On the other hand, a condition of adiposity is a very common cause of infertility. Very fat lambs often do not come in season in a very marked way, and when they do so, the periods are apt to be irregular and may be missed, or the animals may fail to breed altogether. A very low fertility associated with many prize animals fattened for the show or sale ring is a well established fact. The condition, if it has not gone too far, can be corrected by muscular exercise and reduction in the quantity of food given.

There is no doubt that, whatever the condition of the animal, **a rising or improving state of nutrition prior to service is the one most favourable to fertility.** This applies to the male animal as well as to the female. It is well illustrated by the successful results in England, brought about by the process of "flushing" of ewes prior to service. "Flushing" consists of supplying additional food of good quality just before mating in order to stimulate ovulation. This results in the production of a larger number of ripe ova available for fertilisation. In animals that are fit, but not overfed, any sudden increase in the feed will stimulate the functioning of the reproductive organs.

Ewes in the southern portion of this State are usually mated in November, just as the natural feed is drying off, and consequently falling off in feeding value. Mating at this time, or later, is essential in most seasons if the ewes are to be lambed down on green feed the following autumn. This means that under the conditions of sheep husbandry most usual in this State, the period immediately prior to service is one of a **falling** state of nutrition for the ewes or the very reverse of that most conductive to maximum fertility. Obviously, for better lambing percentages, the farmer should make some special provision for his ewes at this time, either by turning them into a particularly good pasture kept for the purpose, or preferably a crop such as oats, peas or lupins, or by hand feeding with a little grain or concentrate. This extra feeding or "flushing" should be started 2-3 weeks before mating. It would bring about that rising state of nutrition necessary for maximum fertility and give improved lamb "drops" in farm flocks.

Pregnancy.—Contrary to general belief the pregnant ewe has very little **extra** food requirements until about the last third of the gestation period. The aim should be to keep her in a healthy, thrifty condition, until about 1-2 months before lambing is due to start, and then to improve the food supply either by suitably feeding or by turning on to a sown crop. The extra food at this time is required:—

1. To provide for the extra requirements of the developing foetus, which by this time have become appreciable.
2. To stimulate the growth of the milk-secreting tissue of the udder. The greater the development of the udder, the greater the **capacity** of the ewe to produce milk for her lamb.

The process of giving extra food of good quality a few weeks **before** the birth of the young so as to stimulate udder development is known as "steaming up," and is used very effectively in England in the dairy industry. It could be used equally effectively in this State in the fat lamb industry where the capacity of the ewe to produce milk is of supreme importance.

In a season such as the present the very good **early** rains will ensure a good growth of young pasture and sown crops, but usually ample hand feeding in April and May is essential for this purpose.

2.—Growth.

After lambing an adequate food supply for the ewe is essential, because **for the first 3 months the growth rate of the lamb is directly dependent on the quantity of milk given by the mother.** Experiments have shown that the quantity of milk available to the lamb is just as important as inherited capacity for growth, i.e., breed. In fact, part of the better growth rate of certain breeds is due to the larger milk yield of the mothers. An average ewe yields from 2½-4 pints of milk daily or 2¼-3½ gallons a week, and the milk is richer than cow's milk, so it is obvious that the food requirements of the milking ewe are very high. It is very necessary for the ewe to have an ample supply of highly digestible food rich in protein and phosphate. The food requirements of lactation are very much higher than those of pregnancy.

In some seasons a certain amount of young green pasture of high feeding value may be available to the lambing ewes by May, but the amount is usually small and normally natural green feed is not plentiful until late in June. If the fat lambs are intended to export, they should be dropped early in May so that fodder crops must be grown to supply the necessary green feed for the ewes. For this purpose the farmer could not de better than sow an early variety of oats or barley, oats and peas, or oats and rape on well prepared fallow with the first rains. These crops come away very quickly and can be grazed heavily, and normally will ensure an ample supply of succulent feed for the lactating ewe. If, as in 1933, the autumn rains are very late, then hand feeding with conserved fodder such as silage or early cut hay with a little oats, peas or linseed are essential if the ewe is to keep up her milk supply and induce the optimum growth rate in her lamb.

For the highest quality product farmers should aim at selling as large a proportion as possible of their lambs "fat off their mothers," preferably at the age of 12-15 weeks. The success of a farmer in fat lamb raising will depend largely on the time and the extent to which he can do this. There will always be a certain percentage of late or unsuitable lambs, however, and the farmer has to decide whether to sell these at lower rates or to keep them for sale as hoggets the following year. If they are to be kept, then provision must be made for feeding them well, particularly just at weaning time and during the summer months, so as to sustain those qualities of carcase for which they have been bred. Suggestions for the summer feeding of young growing sheep have been made in a previous article ("The Summer Feeding of Sheep," by E. J. Underwood, this Journal, Vol. VI., March, 1934), and the necessity for keeping up a high plane of nutrition both to minimise the effects of worm parasites (to which weaners are particularly susceptible) and to sustain normal growth rate was there pointed out.

Summary.—The most important points to be considered in feeding for fat lamb production are:—

1. Have the ewes in an improving state of nutrition at mating time by giving extra food, or turning on to specially good grazing 2-3 weeks prior to mating. Giving of extra food at this time is known as "flushing" the ewes.

2. Keep the ewes in a thrifty condition during pregnancy, with extra food a few weeks before lambing. This is the process of "steaming up."

3. Ensure a good milk supply for the lambs by turning the ewes on to crops such as oats, or oats and rape sown on fallow with the first rains. When the rains are late ample hand feeding must be carried out as the food requirements of the milking ewe are very high.

SUDAN GRASS.

(*Sorghum sudanense, Stapf.*)

G. K. Baron-Hay,
H. G. Elliott,
G. B. W. Meadly.

Confusion still exists regarding the nomenclature of Sudan grass. Some botanists regard it as a separate species under the name *Sorghum sudanense, Stapf.*, while others consider it only a variety of Johnson grass (*Sorghum halepense, Pers.*) owing to the comparatively slender distinctions between the two grasses.

Sudan grass is a native of Africa but has been introduced into many other countries as a summer growing fodder crop.

Description.—An annual or sometimes biennial grass. Culms rather slender up to 10 feet in height. Leaves numerous, about 18 inches long and half-inch wide. Leaf blade convolute in the bud, ligule membranous. Panicle ovate or pyramidal, from six to 12 inches long, and about half as broad at the base. Branches whorled, loose and spreading from the central rachis.

Spikelets of two kinds—one sessile and the other peduncled, those of each pair differing in sex and shape. Sessile spikelet 6-7 mms. long, dorsally compressed, readily deciduous at maturity, together with the peduncled spikelet or at least its peduncle. Peduncled spikelet staminate, narrow. Glumes of sessile spikelet equal, coriaceous, the lower with a broad flattened or convex dorsal surface, the upper boat-shaped. Lemma elliptical to lanceolate, usually glabrous. Grain obovoid, dorsally compressed.

Sudan Grass under Irrigation. L. Temple, Harvey, 1933.

Sudan grass was first introduced into Western Australia in 1918 when trial plots were established at the Merredin and Chapman Experiment Farms, which gave very promising results.

In 1919 no less than 135 farmers were supplied with seed by the Department, the good results from which did much in popularising this plant.

Sudan grass is a highly drought-resistant, summer-growing annual, which matures fairly rapidly and often under ideal conditions the first crop is ready for cutting or grazing six to eight weeks after seeding. Under irrigation three or even four grazings can be obtained during the season.

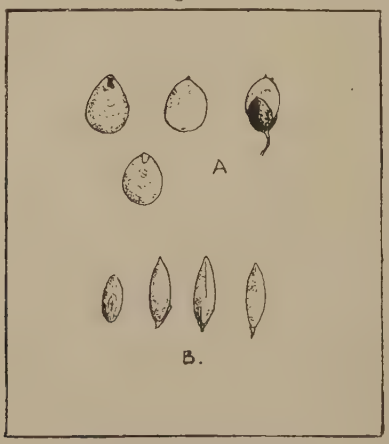
Several factors are essential for the successful cultivation of this grass, and the following information has been prepared to assist farmers wishing to grow this crop.

Soil Requirements.—Sudan grass gives best results when grown on a rich well-drained loam, naturally moist, or where irrigation is available. It, however, has been grown successfully on many types of soil from heavy clay to light sand. Deep light sandy soils are usually disappointing unless enriched with a nitrogenous fertiliser, and supplied with ample moisture.

Preparation of Seed Bed.—The ground should be fallowed as early as possible in the spring to kill weeds, promote nitrification, assist in warming the ground and conserve moisture.

The ideal seed bed is one which is firm and covered with 1 to 1½ inches of loose surface soil. This can be produced by cultivation and harrowing to kill weeds, both after ploughing and prior to seeding.

Diagram I.



A.—Milo Sorghum Seed.
B.—Sudan Grass Seed.

Rolling the land after cultivation and prior to seeding has given good results, but care should be taken to harrow or cultivate lightly after rolling, so as to form a mulch on the surface.

The importance of a good seed bed cannot be stressed too much, as the plant in non-irrigated areas must rely almost entirely on the conserved moisture for its germination and subsequent growth.

Seed.—All growers should be sure that their seed supply is pure. The seed should be of the highest purity and germination and be free from Johnson grass or seeds cross-fertilised with the other sorghums. Sudan grass, being a sorghum, will cross-hybridise very freely with other members of the group, such as Kaffir corn

or milo. These hybrid plants among Sudan grass probably give rise to occasional reports which are made regarding mortality in stock feeding on the crop.

Good seed may be ensured by buying from some reputable source of supply and undertaking an examination of the seed for these sorghum strangers. These may be recognised by their being more or less rounded in shape, whereas Sudan grass seed is flatter, more elongated, and somewhat pointed at the ends. (See Diagram No. I.)

Under the Agricultural Seeds Act, farm seeds are required to be sold with a guarantee of germination and purity. A good sample should have a germination of about 88 per cent., and should not contain more than two per cent. of weed seeds and impurities by weight. By demanding such a guarantee when purchasing seeds, farmers will do much to raise the standard of agricultural seeds.

The weed and other foreign seeds of most frequent occurrence in samples of Sudan grass are:—

Datura stramonium (Thorn Apple).—All parts of this plant are poisonous, especially the seed.

Xanthium spinosum (Bathurst Burr).—A noxious weed.

Chenopodium album (Fat Hen).—Of value as a sheep feed.

Sorghum vulgare (Sorghum).—May be dangerous where the plant is grown for grazing.

Sida retusa (Sida Weed).

Polygonum convolvulus (Black Bird Weed).

Setaria sp. (Millet).

Rate of Seeding.—Unless care is taken to purchase only seed with a high percentage of germination, disappointing results will ensue in districts where only a light sowing is recommended, and definite advice as to the quantities to sow per acre may be misleading.

The following "real value" of five samples of Sudan grass seed examined by the Economic Botanist and Plant Pathologist, and reported in the September, 1925, issue of the *Journal*, demonstrates this.

	Purity.	Germination.	Real Value.	Viable seeds in 10 lbs. seed
	per cent.	per cent.	per cent.	lbs.
Sample A	99·4	81·0	81	8·1
„ B	96·8	38·7	38	3·8
„ C	98·8	51·0	50	5·0
„ D	84·8	58·5	50	5 0
„ E	71·2	74·0	53	5·3

Obviously, therefore, in a district where 3 lbs. of seed per acre is recommended, Sample "A" would give a good crop, whereas Sample "B" would undoubtedly prove a failure, other conditions being the same.

Recommendations, therefore, can only be made for samples reaching the standard laid down above.

Competitions have shown that it is preferable to sow light quantities of seed per acre where the annual rainfall is low, *i.e.*, 16 to 17 inches, and to increase the quantity for districts with a higher rainfall.

DISTRICTS WITH ANNUAL RAINFALL.

——	17 inches or under.	18–23 inches.	24 inches or over.
Quantity Sudan Grass seed per acre	3 lbs.	6 lbs.	10 lbs.

Illustration 2.

1920. 1919.
Showing the Value of Seed Selection.

Method of Seeding.—Sudan grass seed may be either broadcast or sown through a drill.

Broadcasting should not be practised except in districts with an ample rainfall, and the quantity of seed per acre should be increased by one-half over that recommended above.

Unless a broadcasting machine, such as the "Cahoon," or a grass-seeding attachment to the ordinary drill be employed, it is difficult to get an even distribution, which is desirable.

Where hand broadcasting is necessary, a good plan is to mix the seed with a quantity of dry sand or ashes, so that the small quantity of seed per acre may be more easily applied. The usual method, however, is to mix the seed with the fertiliser immediately before seeding, and broadcast the seed with the manure.

Sudan grass, however, is best sown with the drill, mixing the seed with the fertiliser used, and sowing within twenty-four hours.

Illustration 3.

J. M. Riegert, Yarloop. Sudan Grass in the "Wm. Padbury" competition. Yield 7 tons 18 cwt. per acre.

In dry districts some farmers prefer to close up alternate tubes of the drill so as to sow the seed in drills about 14 inches apart, but good results have been obtained in all districts by sowing through every tube, provided seed is not applied too thickly.

There is considerable difference of opinion among farmers as to the wisdom of mixing Sudan grass seed with superphosphate prior to seeding. Mr. J. M. Riegert, Yarloop, who annually grows a considerable area for seed, and has won the Royal Agricultural Society's competition, always mixes the seed with superphosphate, but has found that it is unwise to leave the seed in the manure for more than 24 hours. Mr. G. C. Hodges, Yornaning, who has also grown Sudan grass for a number of years, believes that superphosphate has little effect in damaging the seed.

Work carried out to test the effect of superphosphate on certain small seeds has shown that freshly made superphosphate or damp superphosphate is far more dangerous than the dry fertiliser; also that the deleterious effects of superphosphate is not so great on the smaller grass seeds, which are generally covered with a "husk," as on "naked" seeds, such as rape or kale. The writers believe that, by mixing only enough seed with the manure as will be required for the morning or afternoon's sowing, no harmful effects to the seed will be experienced.

Depth of Planting.—With Sudan grass as with all spring sown crops, deeper planting than is ordinarily practised would be beneficial on loamy or sandy soil. The reason for this with little reflection will be obvious.

All these crops should be sown on well prepared "fallow" which should possess a fine surface mulch.

In light soils this mulch is generally at least two inches in depth and is dry. In order to obtain successful and rapid germination, it is necessary for seeds to be planted just below this mulch and in contact with the damp under soil. Where planted with a drill and not followed by a roller, the ordinary depth practised with wheat has given good results.

The moisture may be brought nearer to the surface by rolling, but the soil should be harrowed immediately after planting is completed, in order to prevent undue loss of moisture.

Illustration 4.

A head of Sudan Grass compared with heads of Sorghum and Sorghum-hybrids. On the left—Sudan Grass; Centre—Hybrid plants; on the right—Sorghum.

(N.S.W. *Journal of Agriculture.*)

Manures.—Sudan grass is a rapid grower and, therefore, will require supplies of easily available plant food. By fallowing the land intended for this crop, usually enough soil nitrogen is produced by the process of nitrification to supply the needs of the plant.

In some districts good results have been obtained with 1 cwt. superphosphate, and at least this dressing per acre is recommended, though heavier dressings may be employed profitably where conditions for moisture conservation are good or irrigation is available.

On irrigated areas 2 cwt. of superphosphate and ammonia No. 3 (superphosphate 2½ parts, sulphate of ammonia 1 part) per acre is recommended.

Time to Plant.—Sudan grass will not germinate in a cold, badly aerated soil, and therefore the date of planting in the spring will vary for different districts of the State. It should not be planted until all danger from frost is over, and the ground warm. This will vary from September in the wheat belt areas to early November in the extreme south-west portions of the State.

Feeding Sudan Grass.—Sudan grass may either be utilised as a green crop or fed as hay. It is in the former condition that this crop is of special value in Western Australia.

All the sorghums, of which Sudan grass is a member, contains a glucoside capable of yielding prussic acid on fermentation. This glucoside is present in the sorghums in dangerous quantities up to the time the plant is forming seed. Sudan grass, however, has not been proved to contain sufficient quantities of this poisonous principle to be dangerous at any time in its growth, and, unless sorghum or sorghum-Sudan grass hybrids are present in the crop, it may be taken as safe for grazing with stock.

Analyses of Sudan grass in this State have shown the entire absence of this cyanogenetic glucoside, while American analyses have shown that a cow or horse would have to eat 155 lbs. of fresh Sudan grass in one feed to obtain a lethal dose. This is almost an impossibility. It is a wise precaution, therefore—before turning stock on to Sudan grass—to walk through the crop and note the prevalence of hybrids and sorghum plants, which may be distinguished by the broad leaves, coarse thick stems, and—if in the head—the short compact heads. Hybrids may show any variation between the true sorghum heads and the very open heads of true Sudan grass. If these plants are in any quantity, the crop should not be fed off until the plants are well in head. If only a few undesirable plants are present, they, of course, may be removed. The seed from such a crop should not be reserved for planting purposes the following year.

Sudan grass compares favourably with maize by analysis, although, as usually grown in this State, the yield per acre would not be so great.

	Water.	Ash.	Crude Protein.	Carbohydrates.		Fat.
				Fibre.	Nitrogen free extract	
	%	%	%	%	%	%
Sudan Grass	63·91	3·1	2·0	8·4	21·5	1·1
Maize	76·9	1·2	1·9	5·5	13·9	0·6

Although a considerable number of feeding trials have been carried out to determine the digestibility of maize, only a few trials have as yet been carried out with Sudan grass in this direction. Such trials, however, have indicated that Sudan grass is relatively very palatable to stock, and has a digestibility of the order of maize.

To this must be added the undoubted value of the grass as a laxative and tonic during a period of the year when no other green material is usually available. Because of this effect on stock, care should be taken not to turn stock which have been living on dry feed suddenly on to green Sudan grass. Stock should be accustomed to the change of diet gradually by allowing them to stay on the Sudan grass only for a short while during the first few days.

Sudan grass makes excellent hay, and good yields may be secured. Mr. A. G. Paterson, Piesse, obtained over one ton per acre in one cutting from about 90 acres, while Mr. J. M. Riegert, Yarloop, reports yields as high as three tons of hay per acre in one cutting.

In addition to the hay crop further grazing is obtained, and the feeding value is good, as shown in the following comparison with oaten hay:—

DIGESTIBLE NUTRIENTS PER 100LBS.

	Protein.	Carbohydrates.	Fat.
Oaten Hay	3·8	43·7	1·6
Sudan Grass Hay	3·3	53·4	0·9

The cultivation of Sudan grass offers an opportunity for supplying the luscious feed so necessary to milking stock in the summer, and owes its drought resistance mainly to its power of rapid growth. It has been noticed to head in 55 days, and illustration I. shows a crop well over five feet in height only seven weeks from time of planting.

Sudan Grass Poisoning.—As a certain amount of doubt still exists in regard to the reputed toxic properties of Sudan grass, the following statement, which appeared in the June, 1934, issue of the "Journal of Agriculture," is reprinted.*

"Sudan grass, when free from hybrids, is not likely to be dangerous at any stage of growth but has the greatest risk where the grass has been stunted by frost or dry conditions. Any risk is minimised by wilting for twenty-four hours prior to feeding.

"If cattle are to be grazed on Sudan grass, care should be taken that they are only put on it for a short time at first, particularly if they are hungry. Sudan grass is as likely to cause hoven or bloat as any other succulent forage.

"These conclusions are in conformity with local experiences."

* Journal of Agriculture, W.A., June, 1934:—"Sorghum, Sudan Grass and Johnson Grass Poisoning."—G. R. W. Meadly.

POWDERY MILDEW ON ROSES.

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This disease is caused by the fungus known as *Sphaerotheca pannosa*, another name for which, in the conidial stage, is *Oidium leucoconium*, whence the common name "Oidium" for this disease. The trouble can be recognised by the occurrence of dusty, whitish, patches on leaves, stems and flower buds. Considerable distortion of foliage may occur and badly affected plants are rendered very unsightly. The quality of the blooms is considerably lowered following the reduction of the vitality of the plant, and flower stalks attacked by the fungus become weakened and may allow the blooms to droop badly.

During the spring and autumn, oidium is very common in most years on numerous varieties of roses. Its prevalence at these seasons of the year is due to the fact that the fungus requires a warm, moderately moist, atmosphere in order to develop successfully. It occurs most commonly on roses growing in shady, moist situations, and on plants that are frequently watered on the foliage and other above-ground parts with a sprinkler or hose.

CONTROL.

Roses should be grown, wherever possible, in a position where they will receive the full force of the sunlight during the whole of the day.

Drainage, if defective, should be improved; also, as indicated above, the frequency of watering should be reduced to a minimum. Heavy, but infrequent, waterings should be the guiding principle. On most occasions the water should only be applied to the soil in which the plants are growing, and not to the leaves. Frequent light waterings with a sprinkler or hose on the foliage are especially "taboo."

During warm weather, dusting the plants with "flowers of sulphur" is advantageous. The sulphur can be distributed by placing it in a bag of hessian or other material of similar texture and shaking the bag over the plants, or it can be applied by means of a special sulphur bellows or dust-gun. The sulphur bellows or dust-gun facilitates treatment of the under-sides of the leaves. A suitable machine can be purchased quite cheaply from any general storekeeper. Sulphuring should be done in the early morning, when the dew on the foliage helps the sulphur to adhere. In the heat of the sun, according to one theory, the sulphur is volatilised and the fumes destroy the fungus. It may be necessary to repeat the sulphur treatment every seven days or so until the advent of very hot dry weather.

Do not apply a very heavy deposit of sulphur, or scorching may occur during very hot days. When each dusting is finished, there should only be a thin film of sulphur, barely perceptible to the naked eye, on the plant.

Because of the ease with which sulphur can be displaced by wind and water after it has been applied to plants, some gardeners prefer to spray with the proprietary preparation known as "lime-sulphur," at the rate of one part by volume of "lime-sulphur" to 50 or 60 parts by volume of water. The "lime-sulphur" treatment is very effective if it is done properly, and it is much longer lasting than the sulphur dusting. It should not be applied during the heat of the day or during very hot weather, or scorching of the leaves, etc., may result. If used in the summer, 1-100 is the best strength. The shade temperature should be below 75° when the spray is applied. Flour may be used as a spreader. One pound should be added to each ten gallons of spray. The flour should be mixed with a little cold or hot water to form a paste and then added to the diluted spray. Calcium caseinate may alternatively be used at the rate of 1 lb. per fifty gallons of diluted spray (or, for smaller amounts use calcium caseinate 1 oz. per 3 gallons of spray. If flour is used, take 4 ozs. per 2½ gallons of spray).

A third method, to be recommended when the plants have been neglected and, therefore, become badly affected, is to spray with a Condy's crystals solution (one ounce of crystals, plus one ounce water glass and one-third ounce of baking soda to five gallons of water). Treatment with Condy's solution will completely clear up an attack of mildew; but the effect is not very lasting and it is advisable to follow with sulphur dusting as soon as the spray has dried off. Repeated spraying of plants with a solution of Condy's crystals has, however, a quite remarkable effect upon the general vigour and tone of the plants. The foliage becomes a darker green and the growth of new shoots and buds appears to be stimulated very considerably. (Instead of "Condy's crystals," potassium permangate may be used, at the same rate.)

"Livers of Sulphur" may be used to control mildew at the rate of one ounce per two gallons of water.

Heavy manuring with sulphate of potash confers considerable resistance to the mildew and also to lime sulphur injury. Over-manuring with nitrogenous compounds makes the plants more susceptible to the disease by stimulating a soft succulent type of growth.

LOCATION AND MANIPULATION OF APIARIES.

H. WILLOUGHBY LANCE,
Apiculturist, Department of Agriculture.

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Success in beekeeping depends on many factors. To be successful, a beekeeper must take to it naturally, from a love of the bees and interest in their work. He needs patience and a capacity for taking pains and working systematically. He should study the flora of his district and know when the various flowers and trees may be expected to blossom.

His hives should be strong, well-made and well-kept. The bees should be of a good race and strain, and strong in numbers.

1. Location of Apiary.

The selection of a suitable site for an apiary is the first and most important consideration for any beekeeper, be he a one-hive man or the large commercial apiarist. There are some sites which will only produce a profitable surplus of honey every second or third year. Other sites will produce a fair average every year, but the quality in flavour and colour will be poor. Generally speaking the sites that produce a first class commercial honey will only produce this every second or third year. This means that the apiarist desiring to secure a good annual income from his bees must have several sites in view, and be prepared to move his bees to the best source of nectar. There are, however, many districts where it is possible to secure enough honey from a few hives to keep the family in honey, and often supply neighbours as well, without moving the bees.

Hives are best placed on a slope facing the morning sun, sheltered if possible from strong winds and the hot afternoon sun. They should not, however, be placed in a damp place or where they will not get the morning sun.

In selecting a district for keeping bees the intending apiarist should first make himself acquainted with the blossoms visited by honey bees for nectar and pollen. He should then find out if such trees or vegetation exist within two or three miles of the proposed site. He should also ascertain if there are many colonies of bees within the district, otherwise overcrowding may take place and the newcomer will not only spoil the harvest of those already there, but obtain a poor return himself.

As regards the distance bees will fly for nectar and pollen, it has generally been considered that the bees seldom flew more than two or three miles. Recent experiments, however, prove that bees will gather both nectar and pollen from a district

8.5 miles from the hive. In these experiments it was shown that the colonies half to two miles away from the source of nectar made greater gains than those within half a mile, while beyond the three mile point returns showed a proportional decrease as the distance increased. This confirms the previous belief that two miles is a profitable bee radius.

2. Government Sites and Registration.

Apiary sites on Government land under the control of the Forestry Department may be obtained on application for £2 per year. This gives the apiarist a radius of two miles bee range from the site and means that no other site will be let closer than four miles. Application for sites should be made to the Forests Department, Perth, from whom full particulars can be obtained.

Sites can also be leased from the Midland Railway Company on similar conditions. Applications should be made to the Midland Railway Company., St. George's Terrace, Perth.

Under the terms of the Bees Act, 1930, all owners of apiaries must register their apiary with the Department of Agriculture, Perth. For the purposes of the Act any place were one or more hives of bees are kept or any place where used beehives or apparatus are kept is an apiary. Penalty for non-registration £5. Application for registration is to be made to the Department on the prescribed form, the fees being 1s. for from one to ten hives, over ten hives 2s. 6d. The fee is not annual.

The purpose of the registrations is to ascertain where bees are being kept, and to enable the Department to prevent the spread of infectious diseases. Apiarists can obtain literature on beekeeping free of charge.

3. Hives.

Box hives without frames are useless for the gathering of honey and are not allowed under Section 12 of the Bees Act, 1930. They cannot be examined and are breeding places for disease and moth.

Some men have standard frames and hives, but have neglected to put wire and foundation into the frames, and the expenditure on frames is worse than useless, as the bees have built the combs anyhow across the frames, which cannot be removed without breaking the comb. Sometimes the frames are fitted with starters or even full sheets of foundation, but owing to the hives not being level the frames do not hang plumb and the combs are built across two frames or, due to the hereditary tendency of some bees to build irregular comb, the combs are built anyhow, and the expenditure and labour are useless.

Another type of hive is the home-made one with incorrect spaces due to the ignorance or indifference of the owner to the habits and methods of bees.

In some of these hives the covers and frames are stuck so tight with propolis that they break before they can be removed, or there is so much unnecessary space, that there is extra comb which has to be broken or cut before the cover or frames can be removed. Beekeepers should remember that the natural working space of the bee is $\frac{1}{4}$ inch. If the space is less than 3/16th of an inch, the bees will fill it up, if more than 5/16th of an inch, they will probably build comb therein.

A previous issue of the *Journal* contained an article on "Bee Hives." This has been reprinted in leaflet form and can be obtained from the Department of Agriculture. The number is 308. It contains particulars and sketches of a home-made hive including a cover or roof which is cheap and more serviceable than most of those seen about apiaries.

4. Combs and Frames.

Good combs and frames are of utmost importance and the beekeepers are advised to obtain leaflet No. 383 on this subject.

5. Bees.

In all primary industries the importance of not only having the best breeds of either seed or livestock, but also of having the breed most suitable to the conditions of the district, has never been so fully realised as at the present time.

In view of this generally acknowledged fact of the importance of good blood, it is surprising to find a large number of bee-keepers who appear to be indifferent to it. In going about the country, one finds very few men who have a really first class bee; they may have a few good colonies, but they do not breed from these, nor do they purchase new pure bred queens. They let nature have its way, allowing the bees to swarm and to re-queen themselves. This method in bee-keeping, as with poultry or any other live stock, tends to the deterioration of the stock.

Selection and breeding from selection is the only way to get the best results, reduce production costs, and enable the farmer, be he bee farmer or other, to meet competition and earn a comfortable living.

Of course this is not the only factor upon which success depends. The general method of conducting the work of the farm is most important, and then there are so many factors over which the farmer has no control, such as the weather, forest fires, etc. This, however, is a certain fact, that in a good season, with a good honey flow, any colony of bees that is fairly strong, will probably do well, even if badly neglected by the owner. But when circumstances are against the industrious bee everything depends upon the strains from which the bees have been bred. Bees from a good stock will survive and perhaps store a surplus, while the indifferent ones will go under. Practically all successful bee-keepers are careful to re-queen every colony at least every two years, and some every year, or even less if the queen does not deliver the goods.

Some bee-keepers breed their own queens from their best colonies, others consider that it pays them better to concentrate on honey production and leave the queen breeding to the expert.

The Department, recognising the importance of good stock, has imported Carniolan queens from Jugo-Slavia, and queens bred from these can be obtained from the Department of Agriculture.

It is claimed for the Carniolan that they are a longer lived bee than the Italian, that they are hardier and will work in weather that keeps the Italian at home, and that they build beautiful white comb and are quiet to handle.

A longer lived bee means a smaller proportion of brood to that of adult bees than would be the case with short-lived bees. That, again, means less food to be consumed by the nurse bees to make chyle food for the larvae. It is usually considered that the life of the average worker bee during the honey season is about six weeks. Assuming workers that will live eight weeks instead of six can be obtained, 25 per cent. of the food required for brood raising will be saved. For instance, assume that we have a hive of 30,000 bees. With our average bee this would require the hatching of 5,000 bees per week to keep up the population of the hives, or 120,000 bees in six months. With a bee living eight weeks, only 3,750 bees would require to be hatched per week, or 90,000 in six months instead of 120,000. We thus realise what an immense saving there would be in food. Leaflet No. 331, dealing with the "Carniolan Bee" can be obtained free from the Department.

6. Ants and Stands.

In some districts ants are a great pest, not only attacking bees that alight on the ground, but climbing the hive and entering therein; the small sugar ants frequently making their nests between the quilt (where these are used) and the cover. That is one reason why the use of quilts is not recommended. It is far better to have a bee space of ¼in. between the tops of frames and the cover.

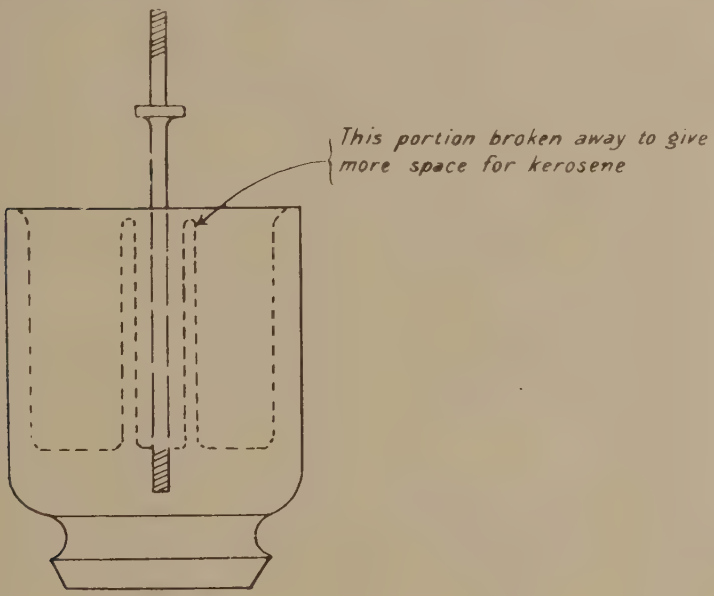


Fig. 1.

The larger types of ants, particularly the Meat Ant (*Iridomyrmex detectus*) attack the hives and cause large numbers of bees to stay home to defend the entrance.

If nests can be located, bi-sulphide of carbon, sheep dip, or cyanogas are good substances for destroying them. A hole, several inches deep, according to size of nest, should be made in the centre, and a quantity of one of the above substances put therein, and the hole covered up. If the nests cannot be located or are too numerous, a good ant-proof stand may be made with the aid of old telegraph insulators. Four pieces of 3 x 2 inches timber are nailed together to make a rectangle the size of the hive, and four inverted insulators let in to the corners underneath. These should be of the hollow type, and the inside collar of china broken away (see Figure 1). This space will now form a cup, which is filled with kerosene or old motor oil from the sump.

If there are a large number of hives, stands to carry three hives are very convenient, and only six insulators need be used instead of 12. If the stand is made nine feet long, this will allow spaces between the hives for placing supers, etc., when manipulating. The insulator legs should be placed directly under the hives, and as these are frequently screwed on to the metal shanks, they can be screwed up or down to adjust the stand to a level. (See Figure 2.)

If old insulators are not obtainable, the legs of the stand may be made of jarrah and stood in the bottom of petrol tins cut down to about 3 inches and filled with old engine oil.

7. Strong Colonies.

The first object of all beekeepers should be to build up strong colonies. The aim should be two 10-frame body boxes boiling over with young bees. It is still the aim of many beekeepers to make a show with a large number of hives, perhaps thinking that means a lot of honey. No greater mistake can be made. A lot of hives frequently mean no honey, whereas a few strong hives mean

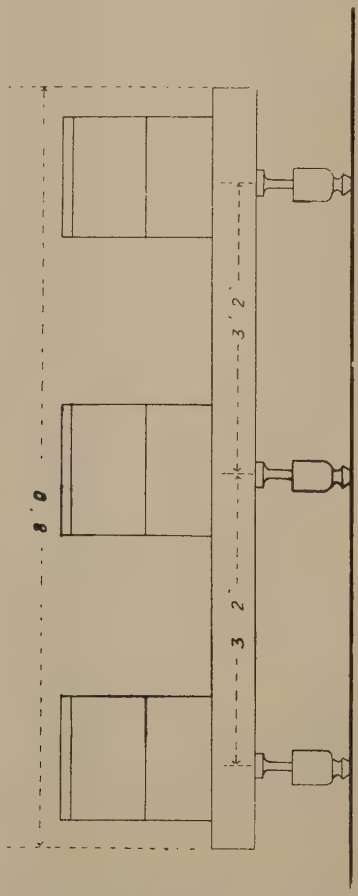


Fig. 2.

plenty of honey and less work. This is realised to such an extent in the United States of America and England that many beekeepers are using 12-frame hives with deeper frames. At the present stage of beekeeping here, this is not recommended, except in special cases, with experienced beekeepers, but every beekeeper is advised to aim at two full-depth bodies packed with bees. Then with a

good honey flow such colonies will fill two or even three honey supers. A good well-bred queen can easily keep these filled with brood during an average season. Cull your queens, and if you have any duds replace them with good stock. Who would be content with a hen that laid one egg per week when he can have one that will lay six or seven. Yet that is what many beekeepers have in the way of queens—those that lay only four or five hundred eggs per day instead of one or two thousand.

8. Transferring.

Many small beekeepers without much experience find it difficult to transfer bees from box hives to frame hives, or from frame hives with a mass of cross combs to new frame hives. For their benefit, particulars of how best to do this are given hereunder.

The transfer should take place, if possible, while there is honey coming in, but it may be done at any time, provided the bees are fed plentifully with sugar or honey syrup after the transfer has taken place. The easiest way of feeding is to obtain a press-top tin, such as is used for honey or golden syrup. Punch a hole or two small holes in the lid and fill with the syrup.

A quilt made of ticking, sacking, or similar material should be placed over the frames and a hole cut in the centre not larger than the size of the tin. The tin of syrup may now be inverted over the hole; the bees will then suck the syrup through the holes. An empty super or box should then be placed on top to cover the tin, and the cover of the hive replaced. At least eight or 10 lbs. of syrup should be given to each hive to enable the bees to build the new comb and lay up a store for breeding.

A syrup may be made for this purpose from sugar, using 10 lbs. sugar, 5 pints water, 1 oz. vinegar, ½ oz. salt. Boil for a few minutes and feed to the bees whilst warm. To make honey syrup, dissolve about 2 parts of honey in 1 part of water. If honey is used, the beekeeper should be quite certain that this does not come from a hive that may have disease, as honey is the principal carrier of foul brood.

To transfer bees from the old box to the new hive, take the box hive and place on the ground upside down so that the bottoms of the combs are exposed, place bricks or blocks of wood under one end of box to give a slope; place the new hive fitted with frames and full sheets of foundation on an empty box so that front edge of floor touches the highest end of box hive; draw body of new hive forward to project over floor about 1½ inches.

Drum sides of box and give a little smoke at lowest end. Bees will then run up highest end of box on to floor of new hive. When nearly all the bees have left the box, the combs of honey can be cut out, some of which should be fed back to the bees after they are in their new hive; the combs of brood should be tied with string into frames and put into centre of new hive.

To transfer bees from hive with cross combs.—The method adopted may be similar to that with box hives, but in this case it may be impossible to cut out the combs of brood, and tie into frames. It should therefore not be adopted unless the hive is very strong with bees and there is a good honey flow.

Another method which may be adopted with both box hives and hives with cross combs when the above are not suitable or easy, is to place the box or old frame hive on top of a new hive fitted with frames and full sheets of foundation, making sure that the only entrance is through the new hive.

As the brood in the old hive hatches out and honey comes in, the bees will fill the empty cells with honey and force the queen down into the new hive. When

upon examination it is found that the queen is in the bottom, or new hive, a queen excluder should be placed over it to prevent her again going to the top box. Four weeks later all brood in the top box will be hatched out, and it may then be removed.

The drawback with this method is the time it takes, as the queen will not be forced down until there is plenty of honey coming in.

9. Re-Queening.

Frequent inquiries are received as to how to re-queen, so a few notes on the matter are given. Of course, the first thing to do is to catch and kill the old queen, otherwise the young one will undoubtedly be killed. The usual process is to lift out the combs one by one and examine until the queen is found. It is handy to have a spare body near the hive so that the frames, as they are examined, may be placed therein; otherwise while one comb is being examined the queen may pass from an unexamined comb to one that has been examined and replaced, and thus she will be missed. If all combs have been examined and the queen not found, carefully examine the floor board and sides of the hive, then re-examine the combs as they are replaced. If she cannot be found another method may be adopted.

Remove the hive some 10 yards away in front of, and with the entrance facing, the old bee stand. Place an empty hive on old position. Now place a white sheet or piece of newspaper in front of the empty hive and an entrance guard over the entrance, open the old hive, take out two or three combs of brood and examine for queen. If not found, shake most of the bees on to the sheet, examine again, and if the queen is not found, place these combs in new hive and fill up the space with empty combs on sheets of foundation. All flying bees will now return to the new queenless hive. Examine bees on sheet, take several of the remaining combs and shake bees off on to the sheet, examining bees after each shaking for the queen, then replace combs in old hive. If queen has not been found, close up the hive and leave until next day. In the meantime large numbers of bees will have sought their old stand and entered the new hive. As the number of bees in the old hive will now have been much reduced, it should not now be difficult to find the queen. This having been done, all the old combs and bees may be transferred to the new hive; or the old hive can be replaced on its old stand and the combs and bees in new hives transferred to it.

The queen having been disposed of, the usual method is to leave the hive queenless for a day, then taking the mailing cage in which the queen has been received, remove the cork or corks and also remove one frame from the hive and wedge the cage in the centre between the remaining frames. In the course of a few days the bees in the cage and those outside will have eaten away the candy and the queen bee released. By this time she will have the scent of the hive, and will be accepted.

Other methods of introduction are—

1. Smearing the queen with honey and placing her directly between the frames.
2. Wetting the queen with water and placing directly between the frames.

Both these methods depend upon the instinct of the bees to clean up the honey or water; by the time this is completed the queen and bees will have the same scent, and the queen will be accepted. Mr. Bartly, of Tasmania, claims that he has been successful with the water method in 98 per cent. of the introductions. His method is to wet the queen by placing her in a short glass tube partly filled with tepid water, shake the tube to and fro, pour off the water and allow the queen to walk down amongst the bees after giving a puff of smoke.

Yet another method which has been recommended to me, and which has been used with complete success, is the paper bag method. Take a small thin paper bag, such as is used for lollies, place the queen to be introduced therein, without any of her attendant bees, then catch half a dozen bees from the hive and place them in the bag with her. These bees should, if possible, be young and filling themselves with honey from the cells when caught. Although the queen is strange to them, they will be so busy trying to get out that they will not take any notice of her, and in the meantime they will all get the same scent. Remove one frame and place the bag in the hive between the frames, and in the course of a few hours the queen will have been released and accepted. The advantage of this method is that there is no need to leave the hive queenless for a day, and the period they are without a queen is so short they do not start queen cells. I have opened a hive, destroyed the queen, and introduced a new one in a paper bag straight away with considerable success.

Whatever method is adopted, the hive should not be disturbed for about three days, after which time it should be opened to see that the queen is "O.K."

Leaflet No. 387 gives further details for catching and introducing queens.

10. Pollen.

As has already been mentioned, apart from honey, the future generation of the hive depends upon a supply of pollen. Pollen is the reproductive substance of flowers, which is transferred from the male to the female portion of the flower or from the male flower to the female flower for the reproduction of species. Nature has provided various methods for this transfer. Amongst these are flying insects, of which bees are the principal. Pollen is the vital substance of the flower in concentrated form, is highly nitrogenous, and contains necessary vitamins. Nature is always prolific, and provides more than is necessary for reproduction purposes. Bees, as they visit flower after flower, carry the pollen from the anthers and fertilise the styles. In doing this they take a toll for their service, and carry some of the surplus pollen away to their hives to make food for their young larvae. When breeding is taking place the nurse bees consume honey and pollen and convert this into chyle food, which is deposited in the larvae cells.

If there is a shortage of pollen, therefore, breeding suffers, and the colonies do not build up, or may dwindle if insufficient bees are not bred to make up for wastage. The importance, therefore, of a pollen substitute has been realised by beekeepers for many years. From experiments that have been made it is evident that the question must be studied scientifically. Recently the Beekeepers' Association of Victoria approached the Commonwealth Committee of Scientific Research with a request that investigation should be made to find a pollen substitute, and this investigation has now been commenced.

The question is being studied in other places, and the following particulars of experiments at the College of Agriculture and Forestry, Brno, Czechoslovakia, will be of interest to beekeepers. As far back as 1871 Fischer propounded the theory that the pharyngeal gland was the source of the larval food. Stephen Soudek at the above College has recently been making microscopical studies of this gland, and his experiments therewith confirm Fischer's conception.

He fed very young bees, which had just emerged from the cells, with different foods and compared the action on the pharyngeal gland. He found that these glands only developed with those bees whose food had contained pollen. In cases where the food only contained honey or sugar, these glands shrank, proving the real importance of pollen. After this he tried many substitutes, amongst which were wheat flour, wheat bran, starch, ground beans, olive seed cake,

linseed cake, peanut cake, ground fish, ground meat, etc. All of these did not bring the pharyngeal gland to development. Only in two cases did the glands become fully turgescent. These were when the young bees were fed with fresh egg albumen stirred into sugar syrup or with dried yeast. He, therefore, assumes that these substances can replace pollen, but states that many further experiments will have to be made before any pronouncement can be made.

He, however, advises beekeepers that as we know of no definite pollen substitute they should, when there is a lack of pollen, feed the bees with the fresh white of an egg stirred into sugar syrup. Pine pollen collected the previous season did not provoke any development of the gland. Bees fed on the yoke of an egg, ground meat and ground fish died in a few days. It is surprising the variety of substances bees will carry into their hive when there is a shortage of pollen. They realise the need for some such substance, and in their extremity have been known to work on wheat shorts fed to cows, fine sawdust, and even coal dust.

The Commonwealth Committee of Scientific Research has commenced investigation, and the results so far show that yeast alone or in admixture with various cheaper protein foods can stimulate the brood food glands to active functioning.

Casein was also found to lead to the development of these glands, and it is suggested that probably a combination of yeast, casein and pollard might prove an effective substitute. Further tests are in progress to determine the cheapest and most effective substitute.

Old pollen that has been stored in the comb for a long time seems to lose its goodness, and bees always prefer the fresh gathered substance.

If there is old hard pollen in the hive, and yet no breeding taking place at the usual time, I would recommend the removal of this pollen by scraping down the comb with a sharp tool almost to the midrib, then pound the pollen—if particles of comb are mixed with it, it will not matter—and stir in with the fresh white of an egg mixed with sugar syrup.

If any method of feeding pollen, or pollen substitute is adopted, care must be taken to feed slowly and to keep up the supply until natural pollen comes in.

11. Feeding.

As a general rule, with proper care, bees do not require to be fed. It should be the aim of all beekeepers to leave plenty of honey in the hive, except at times of heavy honey flow. It is rapidly becoming a custom amongst beekeepers in many countries to leave what is called a food chamber on top of the hives nearly all the year round, containing from 20 to 60 lbs. of honey, according to the season and the district. Beekeepers in Western Australia are recommended to have an extra half depth super for every hive; this should contain from 20 to 30 lbs. honey, and be left on the hive all the year round, empty supers for honey being placed between it and the brood chamber. This gives the bees a feeling of security, and induces them to keep up the population of the hive, and without the fear of starvation.

It is most important that there should be plenty of honey on the hive at the close of winter, as the bees consume a very large amount of honey when brood rearing in the spring.

Dr. E. F. Phillips, in "Beekeeping," estimates that an average strong colony consumes 480 lbs. of honey as follows:—Maintenance 400 lbs., feeding of brood 70 lbs., wax production 10 lbs.

Feeding may be necessary at times, for three different reasons—(1) to provide winter stores, if the food chamber is not full; (2) to stimulate brood rearing;

(3) to provide immediate food for colonies that are short. Feeding should be done inside the hive, for which purpose a variety of feeders may be purchased, the division board feeder being a good one.

An excellent feeder can be made at home by any one handy with tools. This is shown in Fig. 3.

The box is about 6in. x 4in. x 3½in. deep, a division is placed one inch from the end, the bottom only extends to this, thus having an entrance from the bottom, one inch wide. The top of the box consists of a piece of glass which slides in from

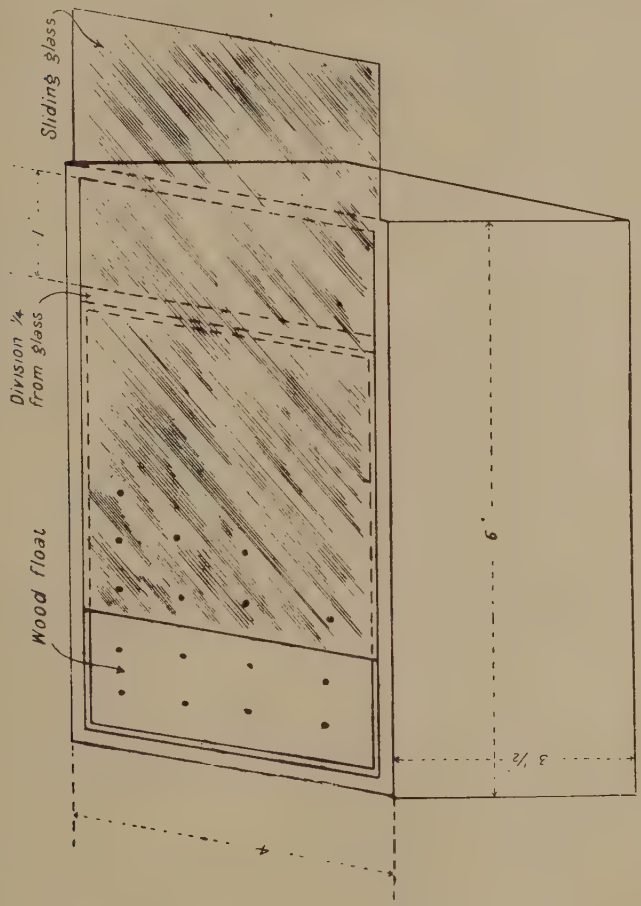


Fig. 3.

the end, a space about ¼in. must be left between the top of the wood division and the glass. A piece of thin wood is now cut about ¾in. smaller, each way, than the inside of the box, and a number of small holes bored therein. The box is filled with syrup, and a piece of wood acts as a float from which the bees feed, coming up through the inch space, extending over the division on to the float.

The advantages of this feeder are that it can be seen when it is empty, and can be refilled without removing from the hive. The inside may be filled with hot wax, swilled round and emptied out. This will make joints honey tight. If the matter is urgent and the beekeeper has not time to make the above, an effective feeder can be made by punching small holes in the top of a press-top tin, which after filling is inverted on to a plate and placed on top of the frames inside a spare super box; or a quilt from some strong material can be put over the frames, a hole cut in the centre, and the inverted tin placed over the hole. This method has the advantage that, during cold weather, the brood nest is kept warmer than with the plate method. If any colonies are weak, only covering a few frames, entrances should be closed to two or three inches.

In many countries where it is cheap, a syrup for feeding is made from sugar, one advantage of which is that it cannot contain foul brood germs. Honey from an unknown source may; but it is certainly the best food if known to come from hives free of disease.

For Winter Stores or Food for Starving Colonies.

The feed may be made of two parts of honey of good density, or of granulated sugar, dissolved in one part of hot water. This should be fed to the bees as rapidly as possible; if fed through a press-top tin, there should be more holes than when the bees are being fed for stimulating brood rearing. If sugar is used, a little vinegar and salt may be added as referred to under "Transferring."

To stimulate brood rearing the syrup may be made much thinner, using equal parts of water and honey or sugar; or even two parts of water to one of honey or sugar; this should not be fed as rapidly as when feeding for stores.

The best time to feed is in the late afternoon after the work of the apiary has ceased, as the scent of the honey is not then so likely to attract robbers.

It is advisable, if possible, to have a number of sealed combs in store, so that if any colony runs short, one of these combs may be placed in the hive, this is much the best way of feeding. If it is desired to stimulate brood rearing, bruise the cappings before placing in the hive.

12. Extracted or Comb Honey.

The small apiarist with a few hives desiring honey for home use, is frequently at a loss how to obtain the honey from the hive and desires to produce comb honey in 1 lb. sections. This is, however, often difficult to produce, and except in good seasons and good localities requires experience. The best plan is to use half depth supers and cut the comb out, replacing this with thin surplus foundation.

For the apiarist with four or more hives an extractor can now be obtained for £3 5s. and the extra amount of honey obtained and labour saved will soon pay for the cost. Larger extractors will of course be required as the number of hives increases.

An article on comb honey production appeared in the *Journal of Agriculture* for September, 1930, but no beginner is advised to attempt to produce comb honey.

13. Wax Moth and Foul-Brood.

The greater and lesser wax moths are often blamed for more than their share of destruction in beehives. Owners of bees often say that moths are responsible for the loss of their bees, but in most cases it is due to inexperience or careless beekeeping. Even beekeepers of long standing make this mistake.

In the first place, colonies must be kept strong with bees of a good pedigree. By this is not meant one body-box full of bees and one or two half empty supers on top. There must be plenty of bees on all combs in districts troubled with moth. Most Italian strains are good battlers against the moth pest, some better than others. Secondly, a large number of home-made hives have not the correct spacing. In many cases the frames are too close to the bottom or sides of the hive. In others they are too close to the cover. In other words, there is not what is called a bee space on all sides of the frame. The bees cannot get through, and start filling the space with propolis. But the moth grub can and does get into these spaces, and the bees, however eager they may be, cannot get at the grub.

In some cases beekeepers use mats of roofing felt, sacking, or other material over the top of the frames; the bees cannot get between the mat and the frame, but the grub can and does. These mats are also a harbour and nesting place for ants. In one case, out of 16 hives with mats on, 15 had ants' nests with thousands of eggs between the mat and the cover.

In normal cases strong colonies should have an entrance of ⅜in. deep by the full length of the hive, but if the colony becomes weak the entrance should be contracted by placing a strip of wood along the entrance, reducing this according to strength from the full entrance down to two inches. This will assist the bees to guard the entrance against moths and robber bees.

If, however, the colony becomes very weak it should be united to another colony. Two weak ones united stand a chance of building up to one strong colony, but if left alone will probably succumb to moths or robber bees.

Do no leave hives more than twelve months without cleaning the floor boards: excessive accumulation of cappings or refuse is a harbour for moth grubs. Once a year at least the floor boards and interior of the hives should be scraped and scrubbed with a solution of Izal: one part of Izal to 300 parts of water will be strong enough. Then leave to dry in the sun.

Always remember that prevention is better than cure.

Dealing with the connection of moths with foul brood, some people think that there is no connection between the two, but in many cases moths have been blamed for destruction which has really been due to foul brood. The moths had only come in afterwards. In the meantime robber bees came along and cleaned up the honey, and carried the infection to other hives.

In one recent case the owner found a hive empty, except for moths. He stated he had fumigated this with bisulphide of carbon, and put a swarm into it. On examination nearly all the combs were found to have either infected larvae or dried-up spores of foul brood. On examination of other hives they were found to have foul brood in the early stages. Probably all of these had started from the one empty hive.

Moral—do not blame the moths for all empty hives. The colonev may have weakened through a failing or poor queen. The hive may have been so constructed as to assist the moth and hinder the bees, or foul brood may have been the cause of the loss of the bees.

The last cause is a very insidious and dangerous one, as it may cause the spread of this very infectious disease due to mistaken diagnosis.

As foul brood has been found in various parts of the State, it behoves all beekeepers to endeavour to correctly ascertain the cause of weak or empty hives. Any empty hives, with or without moth, should be carefully examined for the spores of foul brood in the brood combs, and if any doubt exists, a sample piece of the comb should be sent to the Department of Agriculture.

There are many diseases of bees, but the most dangerous in Australia are those that attack the brood, and the most infectious of these is American foul brood.

Acarine disease, a disease of adult bees, has destroyed thousands of colonies in European countries, but has not yet been found in Australia. There are therefore very strict regulations on all importations of bees into this country. Western Australia also requires a certificate with all importations of bees, honey and second-hand apparatus, whether from abroad or other parts of the Commonwealth, that these come from a district free of foul brood.

Leaflet No. 152 on Bee Diseases is issued free by the Department of Agriculture and can be had on application.

14. Veils and Opening of Hive.

All beekeepers should provide themselves with a veil and smoker. Gloves should not be necessary. A veil gives confidence, as a sting in the eye may be very unpleasant, as well as inducive of much chaff as to how the other fellow got on. Various patterns of veils can be purchased from dealers. The pattern recommended is the W.A. bee veil, made of mosquito netting with a piece of fly wire about 6 inches by 4 inches let in for free vision and to prevent the netting being blown on to the face. The veil should have a piece of elastic to fit round the hat, and another piece to keep the veil close to the chest. These veils can be obtained from James Goss, Perth.

The best fuel to use in the smoker is pine needles, or failing these sheoak needles, both of these smoulder well and give a cool smoke, much better than old bagging.

When ready to open the hive, give two or three puffs of smoke across the entrance, next lift the lid a little, and puff some smoke across the frames, close the lid for a few seconds, then remove the lid and give a little more smoke across the frames, not down into them, as this would probably drive the bees out at the entrance, and give the beekeeper a rear attack.

A hive tool to loosen and remove the frames is also necessary. These can be purchased or made from an old file. The tag end of the file should be heated and bent over to a right angle, and the point flattened out to about ¼ inch. The other end should be ground to a chisel edge; this is useful for scraping and cleaning, while the bent end is used for levering out the frames.

THE GROWING OF SWEET POTATOES.

W. E. COLLINS,
Potato Branch, Department of Agriculture.

Growing to perfection in almost all parts of the State, it is pleasing to note that the sweet potato is finding a place in the home gardens of many people, besides an ever-increasing area in the market gardens. This crop might easily play an important role in the further development of the diversified agricultural industries of the State, more especially since it affords large returns in money from small areas.

The sweet potato belongs to the morning glory family (Convolvulaceæ), and is known botanically as *Ipomoea batatas*. It is a drought-resistant plant and produces a crop of roots with very little moisture.

PREPARING THE GROUND.

A sandy loam, in a warm moist climate, is the ideal location in which to grow sweet potatoes, but like almost all crops, they will adapt themselves to many other classes of climate and of land, always, providing they receive proper attention. Given then, a well-drained, moderately fertile, loose sandy soil, maximum yields should result.

Being a deep-rooted crop, they do well on land that has grown lucerne, clover, peas, etc. Where this is not available, the site selected should be well trenched for garden culture, or sub-soiled for field crops, but, in either case, after cultivation and in addition to fertilisation, it will be wise to compress the lower soil, as this will cause the tubers to grow round or cone-shaped, whereas if the lower soil is left loose they will grow ill-shaped and long.

MANURING.

The sweet potato is a great feeder, and being a heavy yielder requires liberal manuring.

As it does best in lighter soils, the organic matter in these should be built up and maintained by previous growths of leguminous crops, or by heavy dressings of stable manure. When this practice has been followed and the ground is rich in organic matter in order to supply the nitrogen required by the crop, this plant food constituent need not be included in the fertiliser applied. In such cases the fertiliser recommended is a mixture of—

Superphosphate—4 parts,

Sulphate of potash—1 part,

applied at the rate of 3 to 5 cwts. per acre.

When the soil is not well supplied with organic matter, and a dressing of stable manure has not been applied, a complete fertiliser is recommended. Potato manure "H" (No. 8), containing nitrogen 4.00, phosphoric acid 12.70, potash 9.00, is a suitable fertiliser. Apply at the rate of 8 to 12 cwts. per acre.

The fertiliser should be sown when the plants are being set out, but owing to the caustic properties of potash and the presence of such in the above mixtures, care should be exercised that the plants do not come into immediate contact with this agent, as it is likely to burn them. After distributing the fertiliser, it should be well incorporated with the soil prior to planting.

METHODS OF PROPAGATION.

Sweet potatoes are propagated either from vine cuttings or from slips, resulting from the sprouting of shoots from the root. Sets of sweet potato seedlings may be procured from most of the local seedsmen, but when it is desired by the grower to raise the plants himself, it is comparatively easy to do so. Medium sized, well-shaped tubers are to be preferred, and are obtainable from any vegetable market. One bushel (56 lbs.) of tubers should produce about 3,000 plants, or enough for about one-third of an acre.

Place them in a bed of well-rotted stable manure, or leaf mould, mixed with equal quantities of soil—sandy soil for preference—in a warm sheltered position, spacing the roots so that they do not touch one another. After the roots are in place they should be covered with from two to three inches of clean sand.

The bed should be kept moderately moist, and with proper management, vines or slips from four to five inches in height will be ready for the transplanting process in about five or six weeks after placing the roots in the bed. When

pulling the slips, place one hand firmly about the soil, so preventing the dislodging of the parent tuber. After removing the first lot of slips, the bed should be well watered; this will induce the tubers to grow a second crop of plants for further transplantings.

In some instances the slips are allowed to grow to the vine stage, and cuttings are then taken from them. If cuttings are selected, leave about three joints on each, with, if possible, a leaf at one end, and when planting leave one leaf and one joint above ground. If desired the cuttings may be looped, and both ends placed in the soil. Whichever system is followed, the cuttings or slips will soon strike roots and start into leaf.

Some growers put in areas of this crop and propagate direct from small tubers, but this practice is not advised. To strike the plants from slips or cuttings is much more rewarded. Plant in rows 2 feet 6 inches apart, and, say, 1 foot 6 inches between the plants.

VARIETIES.

There are two general types of sweet potatoes grown in the State—(1) the dry mealy-fleshed varieties of the Jersey group, both yellow and red; and (2) the moist-fleshed sweet potatoes represented by the yam groups.

The dry mealy-fleshed sweet potatoes are the varieties most favoured for culinary purposes, and they keep somewhat better. Unfortunately, but very little attention has been given to improve the strains we have, and much might be done to popularise this very excellent vegetable by the introduction of other varieties.

WHEN TO PLANT.

In many parts of the State it is possible to plant the sweet potato from early September till well on in December, and again it may be sown late in February. In the mild districts where frosts are practically unknown, it may be planted in autumn, and left in the ground throughout the winter.

This latter planting would give excellent terminal cuttings for the September crop. Cuttings should be selected from the plants that carry the largest number of roots of good size and uniform shape.

It will soon become apparent to a grower residing in any locality as to when is the correct season of the year in which to put in this crop, and as any hard and fast rule cannot be laid down for the whole State, or as a matter of fact for any one district, local conditions must govern as to when is the best time to plant.

AFTER TREATMENT.

Keep the soil well worked as long as it is possible to do so, and should the vines appear to be making vigorous growth, lift them occasionally to prevent roots striking into the ground from their outer branches. A few applications of liquid manure may be given, but it should be used moderately. Fowl manure, or blood manure, is a good stimulant for this crop, but if not at hand, nitrate of soda or sulphate of ammonia may be used.

HARVESTING AND STORING.

Sweet potatoes may be dug fit for use in about ninety days after planting out, but as a general rule it is best to wait until the vines are brown and discoloured. On account of its excellent keeping qualities, the crop may be left in the ground for weeks unharvested, without likelihood of its decaying. A number of sweet potato growers in the Osborne Park district make it a practice to harvest at one time, just enough to supply the current needs of the markets. In this they show an appreciation of the quality and flavour of the freshly-dug root, and a knowledge of how to eliminate the problem of storage.

The small gardener would do well to adopt their practice, and never harvest more than the actual quantity of roots needed to supply the household for the day.

Should the ground be required for other crops, dig the roots carefully and allow to dry for a few days in an airy storeroom or shed, after which place separately in boxes or crates and cover with dry sand.

YIELD.

The yield of sweet potatoes depends largely upon the locality and soil in which the crop is grown, the kind and amount of fertiliser used, the culture given, and finally upon the variety itself. A yield of 10 tons per acre can be secured from a crop that is grown under favourable conditions. If estimated on a small garden plot basis, 100 plants, spaced four by two feet apart, should produce at least 150 lbs. of merchantable and 50 lbs. of cull roots.

Again, the yield may be increased by the selection, through several seasons, of individual plants producing heavy crops of desirable and well-shaped roots. The most opportune time to select for improvement is when the crop is being harvested. Vine cuttings should be taken from the plants which contain the largest number of roots of good size and uniform shape.

Many plants should be selected for foundation work, because some of them will fail to transmit their prolific characteristics. Within a period of four or five years the grower will be able to establish a desirable strain of fine quality, which he is entitled to call his own, and to give a special name if its characters are sufficiently distinct.

DISEASES AND PESTS.

It has been found that this crop grows remarkably free from fungus diseases, and if good clean tubers are used to produce cuttings or slips, there is not much trouble from this source. It is, however, wise to spray occasionally with Bordeaux or Burgundy Mixture as a preventive.

Slugs are sometimes troublesome in this crop, but dusting from time to time with slaked lime and tobacco dust will keep them in check. Should cutworms or other insects make an appearance, the usual methods of dealing with them must be resorted to, always exercising great care not to apply arsenical or other poisonous substances to the foliage for several weeks prior to using it as stock food, for which purpose it is excellent.

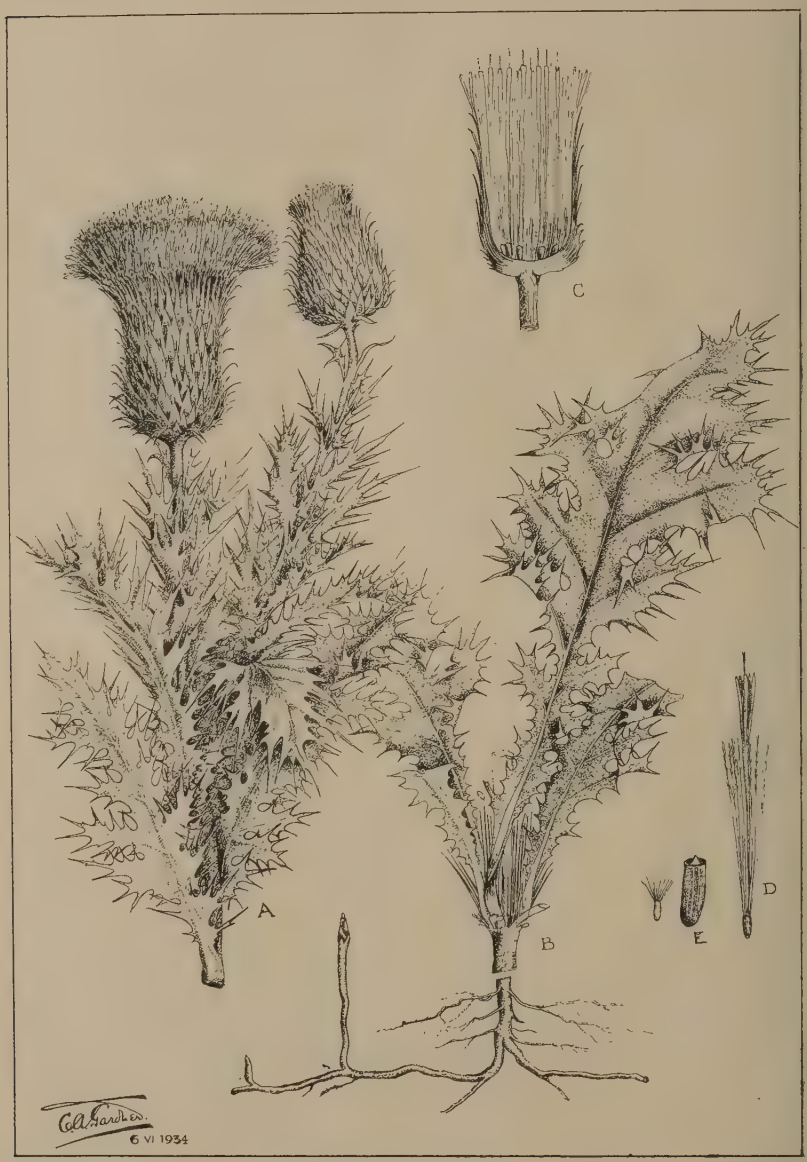
CANADA THISTLE.

(*Cirsium arvense,* (Linn.) Scop.)

A Noxious Weed.

C. A. Gardner, Government Botanist.

The so-called Canada thistle or Creeping thistle is perhaps the most troublesome of all the plants popularly regarded as "thistles." It is native to Europe and Asia, but is now recorded from most temperate and warm temperate countries, and is everywhere regarded as a serious weed. This is principally because of the difficulties of eradication, for the plant is a perennial, with an objectionable underground "rooting system" consisting of numerous subterranean stems which develop laterally at some depth, producing at intervals shoots which later develop into individual plants.



CANADA THISTLE. Cirsium arvense (Linn.) Scop. Geraldton. 1934.

EXPLANATION OF PLATE.

A. Inflorescence and apex of aerial shoot. B. Base of young plant showing basal leaves, roots, and horizontally creeping stems with roots and aerial shoots undeveloped. C. Section through capitulum (flower-head). D. ♂ floret (enlarged). E. Achene (enlarged) with a reduced one at the side.

Geraldton, G. L. Throssell, November, 1933. *Icon. origin.*

The species is recorded as a troublesome weed in the South-Eastern parts of South Australia, where it has been present for some years, and it is regarded as a serious weed in Canada, the United States of America and New Zealand. In November, 1933, Mr. G. L. Throssell found a patch of this plant in the Geraldton district. Following its determination it was immediately gazetted as a Noxious Weed for the State of Western Australia. The plants were eradicated by grubbing, and it is hoped that it has been totally eradicated from this district. This is an example of how a weed can be easily controlled when recognised, but it is almost certain that the plant will reappear elsewhere in the future, so that it is important that farmers should be on the watch for this weed, and when discovered should immediately report, so that action can be taken.

The following botanical description, together with the accompanying plate, should assist farmers in recognising the plant. Generally speaking, it can be recognised from the other locally established thistles by the fact that it is perennial, and produces creeping underground rooting stems. It is this latter feature which makes the plant so undesirable, and difficult to control. The flowers are violet-purple in colour. When appearing as isolated plants, these can be removed by grubbing or hand-pulling. At this stage further methods of control are not given, since it is believed that the plant is not at present to be found in Western Australia.

Description of Plant: —A perennial 1-2 feet in height with horizontally creeping, thickened, white or yellowish, branched roots from which, at irregular intervals, erect stems are produced. Perennial with horizontally creeping thickened subterrannean branching stems which emit at irregular intervals roots and erect leafy stem-like branches 12-30 inches in height, which are annual or biennial to below the surface of the ground. Stems green, cobwebby, with woolly sparse hairs or hairy with bristly hairs, tall, leafy, and corymbosely branched. Leaves green and almost hairless above, woolly-white or cobwebby underneath, lanceolate to oblanceolate in outline, apex acute and terminating in a spine, deeply lobed and undulate with marginal prickles or spines, the base narrowed and continued down the stem beyond the insertion of the leaf, giving the impression of a spiny stem. Inflorescence cymose, the flower-heads stalked or sessile, dioecious (i.e., the males and females borne on different plants). Involucre of numerous appressed closely imbricated bracts in 12 to 18 series, the outer short, ovate or ovate-lanceolate, unarmed or tipped with short weak spines and cobwebby on the back, the inner successively longer and narrower, glabrous with long pointed tips. Florets reddish-violet or rarely white, fragrant. Pappus white, becoming slightly tawny at maturity, the hairs plumose to below the middle, and united at the base to form a short ring, deciduous. Achenes "seeds" from 2-3.5mm. long by .9-1.2mm broad at the thickest point, fusiform in outline, more or less bluntly 4-angled, the apex surrounded by a circular rim within which is a small projection —the base of the style: light brown in colour with a more or less glossy surface. Receptacle covered with hairs 1-1.5cm long, at first white, but coming tawny when the achenes ripen. Flowering season: November to February.

Cirsium from the Greco-Latin *cirsion*, the name of some species of thistle; arvense, (Latin) of ploughed fields.

SOME IMPORTANT FUNGAL DISEASES OF GRAPE VINES AND FRUIT TREES IN WESTERN AUSTRALIA AND THEIR CONTROL.

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1. INTRODUCTION.

Orchardists and vignerons in Western Australia are exceedingly fortunate, in that many of the serious diseases and insect pests which annually cause enormous havoc in other parts of the world, including the Eastern States of Australia, have not yet become established in this State.

Thus the Codlin Moth (*Cydia pomonella*) of apples, pears and other pome fruits, is not present here, although some eleven distinct outbreaks have occurred to date. These have all been entirely suppressed, however, as the result of the activities of officers of the Horticultural and Entomological Branches of the Department of Agriculture, acting with the wholehearted co-operation of the growers concerned.*

The black spot or scab disease of the apple (pathogen *Venturia inaequalis*). is also at present unknown here, although two outbreaks occurred in 1930.† In this instance also, with the enthusiastic co-operation of the growers, both outbreaks were suppressed by departmental action, without the destruction of any trees being necessary.

The dreaded downy mildew disease of the grape (pathogen *Plasmopara viticola*) is not yet with us, although serious enough in the Eastern States. Phylloxera (*Phylloxera vastatrix*) and the erinose mite (*Eriophyes vitis*) of the vine, black rot of grapes (pathogen *Guignardia bidwellii*), brown rot of stone fruits (pathogen *Sclerotinia fructicola*), black spot of citrus (pathogen *Phoma citricarpa*), citrus scab (pathogen *Sporotrichum citri*) and pear leaf blister mite (*Eriophyes pyri*), are further examples of troubles, which, serious enough in parts of the Eastern States of the Commonwealth, are unknown here.

* Wickens, Geo. W.:—"Successful Codlin Moth Control in Western Australia." Journal Dept. Agric., W.A., Vol. 5 (2nd series), No. 1. pp. 52-57, March, 1928. (Reprinted as Leaflet No. 243.)

† Pittman, H. A.:—"'Black Spot' or 'Scab' of Apples and Pears in Western Australia." Journal Dept. Agric., W.A., Vol. 7 (2nd series), No. 2, pp. 241-263, June, 1930. (Reprinted as Bulletin 306.)

Nevertheless the Western Australian fruit grower is not without his share of trouble, from a plant disease point of view, as will become obvious from a perusal of what follows hereinafter.

Some of the most common and important fungal troubles with which the grower in this State has to contend, and the measures which have been found necessary for their prevention or control will now be briefly discussed.

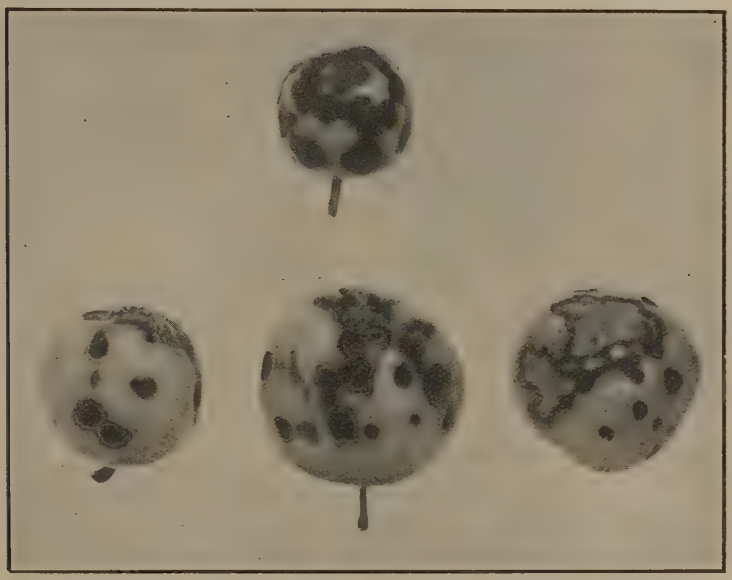

Fig. 1.—"Cleopatra" apples from a 17-acre apple orchard at Manjimup, W.A., which were submitted on 4th April, 1930, to the Department of Agriculture for report as to the disease present. The apples were found to be badly affected with the "Black Spot" or "Scab" disease caused by the fungus *Venturia inaequalis* (*Fusicladium dendriticum*); this being the first unquestionable record of the disease in Western Australia. On the 29th idem, several "Granny Smith" apples similarly affected were submitted from a small orchard at the Porongorups, about 100 miles, as the crow flies, from the first outbreak. In both instances rigorous spraying and other measures were immediately taken by the Department of Agriculture in an attempt to wipe out the disease. These were successful, no infected leaves or fruit being found during the following season on the larger orchard and only two or three apples and a few leaves being found affected during 1930-31 on the smaller orchard. Since that time no infected leaves or fruit have been found in any orchard in Western Australia. The eradication measures included repeated sprayings with strong Bordeaux mixture, immediate destruction of all diseased fruits, the use of a quick-growing cover crop during the autumn and winter to hold the fallen leaves *in situ*, and thorough ploughing and digging under of infected leaves in the early spring before the breaking of the dormancy of the trees, followed by further Bordeaux sprayings until success was achieved.

It is worthy of note that the eradication of the disease was achieved without the destruction of a single tree being necessary. (See Fig. 2 and legend thereunder.)

[*Photo. by author.*]

2. POWDERY MILDEW OR OIDIUM OF GRAPES.

Taking firstly grapes, as being a crop grown extensively for pleasure and profit in the metropolitan and nearby areas by a very large proportion of the community. There are here two diseases to be considered namely, firstly, powdery mildew or oidium, and, secondly, black spot or anthracnose. The first is by far the most widespread and most commonly met with, as it thrives wherever grapes are grown, irrespective of soil type, provided that the environmental conditions are warm and moderately humid. It is particularly prevalent in "backyard"

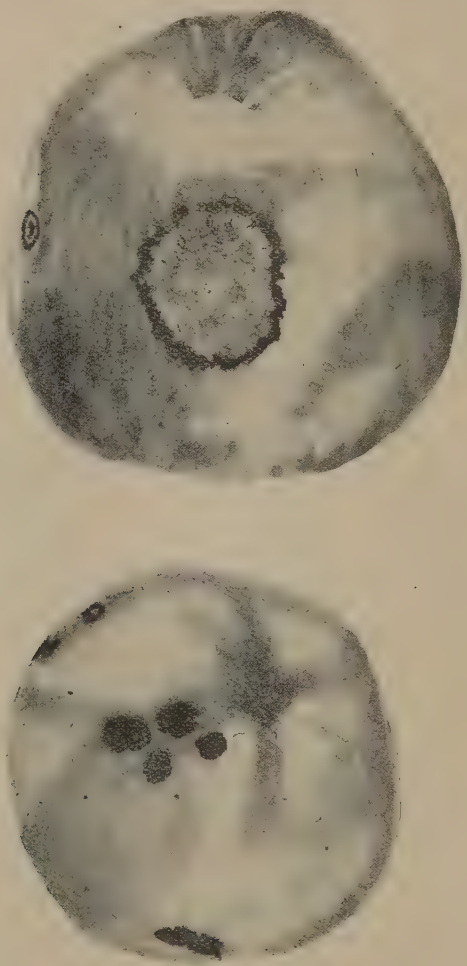

Fig. 2.—Upper—Early infection of "Delicious" apple with the "Apple Scab" or "Black Spot" fungus, *Venturia inaequalis* (*Fusicladium dendriticum*). Note the large size of the spot, black margin, and the russetted central area. Natural size.

Lower—Late infection of "Doherty" ("Dougherty") apple showing small size of lesions formed under such circumstances. Natural size.

Since the "Black Spot" or "Scab" disease of apples was discovered in Western Australia in the autumn of 1930, there have been four crops of apples grown and harvested in this State free from this disease. The total areas of bearing and non-productive apple trees in Western Australia during this period have averaged approximately 8,000 and 3,500 acres, respectively, per annum. Experiments conducted by Miss Joan Hearman at Mt. Barker in 1932-33 on the closely related "Black Spot" or "Scab" disease of pears (see this Journal, pages 292-316, June, 1933), showed that the pear disease could be controlled at a minimum cost, for spray materials only, using Bordeaux Mixture, of 3.56 pence per tree. At 100 trees to the acre, and taking this same figure as a conservative estimate of the cost of the spray materials which would be required for an average-sized bearing apple tree, the saving to the apple growers of Western Australia during every year that the "Black Spot" disease of apples is not existent in this State is approximately £12,000 per annum for spray materials alone, even if the non-productive area is entirely excluded. (See Fig. 1 and legend thereunder.)

[*Both illustrations after the photos. by E. Bruce Levy in G. H. Cunningham's "Fungous Diseases of Fruit Trees in New Zealand."*]

gardens, where the grapes are frequently grown in a too shady place and are often too liberally watered.

Oidium, or powdery mildew, is caused by a fungus known, in the "perfect" stage, as *Uncinula necator*. As commonly met with in this State it occurs in the "imperfect" spore form known as *Oidium Tuckeri*. The fungus causes whitish, dusty-looking patches to appear on the upper and lower surfaces of the leaves, on the young canes and on the berries. The infected areas look somewhat as though finely divided flour had been sprinkled on them. The disease is frequently responsible for very poor setting and scraggly bunches, and for cracking of the berries just before ripening. Infected berries may fail to develop the normal sweetness and flavour characteristic of the uninjured fruit. Berries or canes from which the superficial fungal growth has been rubbed away show a characteristic brownish, russet-like, marking. The fungus grows for the most part externally, absorbing nourishment by root-like structures (*haustoria*) pushed down through the skin (*epidermis*). It is greatly encouraged by shady conditions, by frequent watering of the vines, and especially by the use of a hose or sprinkler on the foliage. Vines grown on the shady side of a house or over a trellis adjoining a dwelling are often very seriously attacked, owing to the insufficient exposure of the fruits and foliage to air circulation and sunlight. The fungus grows best during humid, "muggy," or sultry weather, at temperatures between 75 and 95 degrees Fahrenheit.

CONTROL OF OIDIUM OR POWDERY MILDEW OF GRAPES.

As to its control, the most important point to be borne in mind is that the disease is much easier to prevent than to check after it has been allowed to become well established.

1. Grapes should, wherever possible, be grown in a situation where they will receive the full force of the sunlight during the whole of the day.

2. During the winter time any large unnecessary branches should be removed, so as to allow of free circulation of air and sunlight during the subsequent growth of the vine.

3. During the summer season, if excessively vigorous growth is being made, judicious thinning-out or cutting back of the growth should be carried out, so as to allow of plenty of air and sunlight penetrating into the interior of the vine.

4. Watering should be reduced to a minimum. Although young grape vines need plenty of water in the Perth sand until they become established, older vines will frequently grow quite satisfactorily on the natural rainfall alone.

5. In addition to the above precautions, the shoots should be dusted with sulphur in the spring when about 3 to 4 inches long, and light dustings with "Flowers of Sulphur" should be given from then onwards, in "backyard" gardens, as a precautionary measure, every 10 days or so until the berries commence to ripen or change colour. It is especially important that the bunches be sulphured at blossoming time. This greatly assists in the setting of the fruit, even in the absence of the mildew fungus. In commercial plantings three (3) or more sulphurings may be required as a routine procedure, depending on weather conditions. The first is given just after the shoots develop in the spring, the second at blossoming time, the third a fortnight or so later. Subsequent dustings in commercial plantings generally depend on weather conditions, the growers not giving further dustings unless warm "muggy" conditions develop. In such cases further dustings are immediately given.

The sulphur can be applied by shaking it through a piece of hessian or some similar rather coarse material, or by the use of a special sulphur bellows or dust-gun. Although the sulphur should be applied frequently, it is very important not to apply any great amount to any one place at any one time. When the sulphuring is over, every part of the vine (including the berries) should be just covered with a slight film of sulphur which is barely perceptible to the naked eye. If heavy dustings of sulphur are left on the berries or the leaves, especially during the hottest portion of the year, considerable sulphur scorching may take place during the very hot days.

Where the mildew is already well established, it can be killed by spraying with potassium permanganate (or Condy's crystals) at the rate of 1 lb. of the crystals, 1 lb. of water glass, and one-third pound of baking soda to every 75 gallons of water.* The materials should be thoroughly dissolved in the water and thoroughly mixed before applying to the vine. In applying the spray an effort should be made to thoroughly wet the interior of the vine where the mildew is most abundant. This liquid spray kills only those portions of the fungus that it actually wets, and has little or no effect in preventing further growth of that which is not killed.

(For small quantities the proportions are:—1 oz. permanganate of potash, 1 oz. waterglass, one-third oz. baking soda, and 5 gallons of water.)

To prevent further attack, therefore, the vines should be carefully and thoroughly sulphured as soon after spraying as they are dry, the sulphuring not being delayed more than a day or two after the application of the spray.

The liquid potassium permanganate spray, followed, when dry, by dusting with flowers of sulphur, is usually sufficient to check even a very severe attack of mildew.

3. BLACK SPOT OR ANTHRACNOSE OF GRAPES.

Black Spot of grapes is well established in many vineyards of the coastal plains and foothills. Away from the coast the vineyards are either free or infection is relatively light. It is caused by the fungus called *Gloeosporium ampelophagum.*

Varieties differ considerably in their susceptibility. Black spot is rarely met with in "backyard" grape vines of the metropolitan area, as it appears to dislike sandy soils, but it may cause serious cankering of canes and injuries to leaves and fruit on heavy clay soils in commercial plantings. Sultanas, Malagas, Ohanez (Almeria), Muscats, and Grenache are very liable. Gros Coleman appears to be practically immune.

All green parts of the vine are subject to attack. Dark spots, which grow larger and darker, appear on the berries. The spots are rounded, the centres become sunken and grey in colour, and the margins become reddish or purple. If attacked when very small the berries may become dry and fall; if larger, they become deformed and frequently crack. The flowering stalks are frequently attacked and often become girdled by cankerous spots, causing the flowers or fruits to dry up or fall. On canes the spots become elongated and form dark-coloured pits or cankers with raised edges exposing the wood in the centre. These cankers run lengthwise along the canes and may persist for years. On the leaves the spots are pale grey with dark red or purple borders.

Black Spot is principally a spring disease in this State, developing rapidly so long as the weather is moist or humid. With the usual dry summer weather little

* Jacob, H. E.:—"Powdery Mildew of the Grape and its Control in California," Circular 31, California Agricultural Extension Service, College of Agriculture, University of California, March, 1929.

further infection takes place, but should the wet season continue late, or unseasonable summer rains occur, the disease may continue to spread and make the grower's ordinary methods of control insufficient. Such seasons lead some growers to blame the control measures, not realising that spraying must be adapted to the season and that no hard-and-fast rules as to the number of sprayings required can be laid down.

Fig. 3.—"Black Spot" or "Anthracnose" of grapes, caused by the fungus *Glocosporium ampelophagum*.

[*After W. M. Carne, this Journal, June*, 1926.]

CONTROL OF BLACK SPOT OR ANTHRACNOSE OF GRAPES.

The control measures are as follows:—

Firstly, cut out all badly cankered areas and burn all prunings.

Secondly, remove old loose bark wherever possible and burn it.

Thirdly, spray the pruned vines during the *dormant* period with 20-20-40 Bordeaux mixture. This mixture is difficult to handle with the spray pumps, so that some growers have dropped out the lime and use 10 to 20 lbs. of bluestone "straight" to 40 gallons of water. Under our climatic conditions this is quite effective, so that the traditional sulphuric acid and sulphate of iron swab is rarely used nowadays in Western Australia. The majority of growers use from 12 to 15 lbs. of bluestone to 40 gallons of water as a dormant spray, with good results.

Alternatively to recommendation three, if preferred, swab the vines while still dormant with 8 lbs. (3½ pints approx.) strong commercial sulphuric acid, 35 lbs. sulphate of iron, and 10 gallons of water.

Dissolve the sulphate of iron in hot water or by suspending over night in a piece of bagging in water. Add the acid slowly, while stirring, to prevent spurting.

Fig. 4.—"Black Spot" or "Anthracnose" of grapes, showing effects of attack on young fruit.
[*After W. M. Carne, this Journal, June,* 1926.]

Use a wooden or earthenware vessel. Apply the solution to the vines by means of a small tar brush, a brush made of binder twine on a long handle, or a mop made of woollen rags.

Fourthly, when the buds are bursting, spray with Bordeaux mixture (6.6.40) A second spraying just before blossoming, with Bordeaux (6.6.40), followed by a third after the fruit is set (6.6.40), is usually sufficient. If the spring is dry the second and third sprayings may not be necessary, but if the season continues late, or if summer rains occur, further sprays may be advisable. Later sprayings should be weakened to 50 gallons instead of 40 gallons of water. It is an advantage if a suitable spray spreader such as calcium caseinate is incorporated in the spray on every occasion.

Once the fruit has set, special care should be taken to see that the bunches are well sprayed.

Careful watch should be kept, a spraying following when evidence of the disease spreading is noted. The climatic conditions favouring the disease are (1) humid weather, and (2) rain or heavy dew followed by sunshine*

4. PEACH LEAF CURL.

The disease known as peach leaf curl is caused by the fungus known as *Taphrina deformans*. It occurs wherever peaches and nectarines can be grown successfully, and is a common spring and early summer disease in this State. It also attacks almonds and apricots in some countries, but has not been recorded on these fruits in Western Australia. It is always to be expected in the spring, when preventive measures have not been taken.

Leaf Curl directly affects the leaves, and to a lesser extent the shoots, blossoms and fruits. Evidence of the disease may show soon after the first leaves unfold. The leaves become enlarged, thickened, blistered, and greatly distorted over their affected parts. The whole of a leaf may be affected, but usually only portions of variable size show the characteristic swelling and blistering. The curled portions are at first green, then yellow, whitish, or yellow with a pink tinge, and may become a deep red. A whitish bloom covers the surface. Finally the affected leaves turn brown, die and fall. In this State no further infection usually occurs, new leaves are produced, and by Christmas the trees appear quite normal.

Infection of shoots and fruits is less common than leaf infection. Affected shoots are stunted, curved, and more or less distorted, and the terminal bud usually dies. Flower infection has not been noted here. Where it occurs it causes the blossoms to die and fall. Fruit infection with us occurs on nectarines, and more rarely peaches. Rough, red, irregular blistered areas are developed, giving the appearance of early ripening.

CONTROL OF PEACH LEAF CURL.

Fortunately Leaf Curl is easily controlled. In fact it responds to treatment more readily than any other important disease of fruit trees. One spraying with lime-sulphur (1-10) or Bordeaux mixture (6-4-40) at any time during the dormant period is effective. When San José Scale is present in the orchard, spraying with lime-sulphur (1-7) when the buds begin to swell is necessary. This will also control Leaf Curl without the use of a true dormant spray.

If for any reason preventive spraying is not carried out, and the leaves of peach, nectarine, almond or apricot trees actually become infected little can be done, in this State, until the next season, with safety, as the foliage and fruits

* A more detailed account of this disease and its control may be found in the article "Black Spot or Anthracnose of the Grape Vine," by W. M. Carne, in this Journal, Vol. 3 (2nd series), No. 2, pp. 178-182, June, 1926. (Reprinted as Leaflet 185.)

of "stone fruits" are very subject to injury by spray mixtures, except at very dilute concentrations, during the summer months. Usually, however, Leaf Curl disappears as the weather becomes hotter and drier towards Christmas and does not re-appear till the following spring.

5. "SHOT HOLE" OF STONE FRUITS.

The "Shot Hole" disease of stone fruits, caused by the fungus *Clasterosporium carpophilum*, is particularly serious each year on early peaches, almonds, plums and apricots which come into growth while the cold wet weather of late winter or early spring still persists. It causes destruction of the blossom buds, irregular cankers on the shoots, dying back and gumming of the twigs, warty, scabby, russetted or fissured areas on the fruits, dwarfing of the fruits, and the familiar holes in the leaves which cause them to appear as though the foliage had been peppered with pellets from a shot gun.

CONTROL OF "SHOT HOLE" OF STONE FRUITS.

For controlling "Shot Hole" (pathogen *Clasterosporium carpophilum*) (and incidentally "Leaf Curl" simultaneously) the best treatment is to delay the dormant spraying until the first buds are just starting to move in the spring ("early pink bud" stage). Then spray very thoroughly with Bordeaux (6-4-40), to every 40 gallons of which has been added ½ lb. of calcium caseinate as a spreader.

If a second spraying is required for "Shot Hole" in the spring, after the early pink bud stage, "lime-sulphur" one part to about 100 parts by volume of water, plus 1 lb. calcium caseinate spray spreader to each 100 gallons, may be used for peaches, almonds or plums, after the fruit is set, *provided the weather is still cool*, or Bordeaux mixture 3-4-50 plus caseinate spreader as above, for apricots.

(In addition to the spraying with 6-4-40 Bordeaux mixture plus spreader at the "early pink bud" stage already referred to, it is an advantage in controlling "Shot Hole" to spray each year just before the leaves normally fall away in the autumn, using Bordeaux mixture of the same strength, 6-4-40.)

Apricots should never be sprayed with lime-sulphur when in leaf, nor should peaches, almonds or plums be sprayed with Bordeaux mixture after the "early pink bud" stage (except just before the dormant period), or considerable dropping of leaves and fruit may result.

6. GREEN ROT OF APRICOTS.

"Green Rot" of newly-formed apricot fruits (pathogen *Sclerotinia sclerotiorum*) which has been met with in this State on several occasions recently, during very wet springs, may necessitate a further spraying with Bordeaux, 3-4-50, a fortnight or so later than the "fruit set" spray already referred to in the previous section. Apricot fruits affected with this disease develop a soft, brown, collapsed area while they are small, intensely green, and still encircled by the dead flower parts or "shucks."

A satisfactory schedule for the control of "shot hole" and "green rot" on apricots *only*, therefore, is as follows:—

(1) Bordeaux 6-4-40 plus ½ lb. calcium caseinate spreader per every 40 gallons, just before the leaves normally fall away in the autumn.

(2) As No. 1, at the "early pink bud" stage.

(3) Bordeaux 3-4-50 plus ½ lb. calcium caseinate spreader per every 50 gallons, at "fruit set" stage.

(4) As recommendation No. 3, a fortnight later than "fruit set" stage.

7. BROWN ROT OF CITRUS.

There are two forms of "Brown Rot" present in this State on *Citrus spp.*, one of which, the Australian form, due to the fungus *Phytophthora hibernalis*, Carne, occurs mainly during the cold wet weather of the winter, while the other, the Californian form, caused by *Phytophthora* (*Pythiacystis*) *citrophthora* (Smith and Smith), Leonian, causes losses during the warm moist weather of the late autumn or spring.

SYMPTOMS OF THE DISEASE—GENERAL CONSIDERATIONS.

The "Californian" Brown Rot is mainly a disease of lemon leaves and fruit. On the other hand, the "Australian" form attacks oranges and mandarins more frequently than lemons.

Both forms occur very much more seriously on very heavy clay soil with a high moisture content than on lighter and better drained soils. Lemon trees growing on very sandy soil frequently show hardly any trace of Brown Rot, whereas similar trees on heavy soil a short distance away in the same orchard, may, at the same period, be almost completely defoliated and have most of the fruit affected.

The symptoms shown by affected fruits and leaves are very much the same no matter by which of the two parasites the disease is caused.

FRUIT SYMPTOMS OF BROWN ROT OF CITRUS.

Affected orange and mandarin fruits develop a dull reddish-brown area, usually on one side, which spreads outwards from the original point of infection in a more or less circular fashion until the whole of the fruit may be involved. The affected areas remain firm to the touch unless secondary organisms have gained entry. Orange, lemon and mandarin fruits affected with Brown Rot are accompanied by a very penetrating and characteristic, not-unpleasant, odour, quite distinct from the odours produced in rotting citrus fruits by such organisms as "Blue Moulds" (*Penicillium* spp.) or the "Sour Rot" fungus (*Oospora citri-aurantii*).

The first-infected fruits and leaves are generally those in contact with, or close to, the soil, but later on infected fruits and leaves may be found at any position in the tree, due to the flicking of spores (fungus-seeds) in drops of moisture, by the movement of the branches, to higher parts of the same or neighbouring trees. In general, however, the disease is progressively less abundant towards the top of the tree.

Affected lemon fruits develop a washed-out, tightly-drawn, pale yellow or almost white colour on the diseased areas, showing in marked contrast to the brighter yellow of the sound skin. A pink or reddish stain may mark the point of infection. The affected areas eventually turn brown. In the rare absence of secondary infection, diseased fruits shrink and dry.

LEAF SYMPTOMS OF BROWN ROT OF CITRUS.

Affected leaves of lemons, oranges and mandarins develop dark-coloured, water-soaked areas, usually at the tips, but sometimes at the edges, or occasionally located in the middle of a leaf. Diseased leaves curl up towards the tips and characteristically fall very readily while still green and healthy-looking over the greater part of their surfaces. The falling of the leaves is one of the most obvious signs of the disease in the early stages. Affected leaves which remain attached to the trees eventually become brown in colour over the diseased areas.

CONTROL OF BROWN ROT IN CITRUS.

1. The winter form of Brown Rot can be very readily prevented in this State by spraying the lower two-thirds of the trees in the autumn, say at the middle to the end of April, before the autumn rains commence, with home-made Bordeaux mixture, 5-5-50. To insure the maximum possible protection, ½ lb. of calcium caseinate spreader should be added to each 50 gallons of spray. The trunks of the trees should be well drenched with the spray as a precautionary measure against "Brown Rot" gummosis, which has been found on the trunks of citrus trees, especially lemons, in several orchards in this State on very heavy moist soils.

2. To guard against infection in the spring by the "Californian" organism, spray the lower two-thirds of the trees with Bordeaux 5-5-50 in late winter or very early spring, say in the first or second week of August.

3. In addition to spraying in the autumn and early spring with Bordeaux mixture, the control of this disease will be facilitated if any excess branches are thinned out, so as to allow plenty of light and air into the centres of the trees to dry up the moisture as rapidly as possible after rain or dew, etc.

4. Any very low-hanging branches which tend to drag on the ground in the wind, or when weighted down by fruit or by rain, should be pruned back so as to leave at least a foot of clear space above the ground all round the tree. This will allow greater freedom of air and light movement, and will facilitate the drying of the leaves and fruit after rain or dews, etc. The Brown Rot fungi (*Phytophthora spp.*) are water-loving organisms, and it is only in the presence of abundance of moisture that they can infect the plant tissues.

5. Drainage, if defective, should be improved.

6. Should the spraying not have been done early enough to prevent the disease establishing itself, spraying should be carried out at the earliest opportunity, *i.e.*, during the earliest fine, quick-drying, weather.

7. All diseased fruits should be gathered up and destroyed by boiling, or burying in a deep hole well away from the site of the orchard and where there will be no danger of flood waters unearthing them and spreading them around the countryside.*

8. STEM-END BROWNING OR ANTHRACNOSE OF NAVEL ORANGES.

For the past half-dozen years or more, a disease known locally as "stem-end browning" has been gradually increasing in seriousness on navel orange fruits grown in this State. The disease does not appear to cause any injury of economic importance to any other variety of citrus fruits. Very rarely a Late Valencia orange has been submitted for examination affected with this disease, and growers report that the same condition has been noticed occasionally on the Jaffa orange, which is only grown here on a very small scale. Mandarins have frequently been submitted showing a rather similar condition, but lemons appear to be quite immune.

The disease is unheard of each year until about the last week in June, when a few specimens of affected navel oranges generally arrive at head office from anxious growers. From then on, all through July, specimens of diseased navel oranges are submitted in large numbers.

The influx of worried growers and the arrival of specimens cease about the beginning of August as dramatically as they commence, and nothing more is heard about the disease until about the last week in June of the following year. The incidence of the disease coincides, therefore, with the period of the year when the navel oranges are fully mature.

* For a more detailed account of "Brown Rot of Citrus," see article of this title, by H. A. Pittman, in this Journal, Vol. IX. (2nd series), No. 2, pp. 286-289, June, 1932. (Reprinted as Leaflet 354.)

SYMPTOMS OF STEM-END BROWNING OR ANTHRACNOSE OF NAVEL ORANGES.

Affected fruits are almost invariably injured on the stem side of the equatorial region, that is to say, on the "northern hemisphere." The lesions, if very well developed, may, however, extend down below the equatorial zone, but the region near the navel has not been seen to be affected. The lesions take the form of a light to dark brown irregular area which in the early stages is not clearly marked off from the unaffected skin. In the early stages there is no depression of the skin over the injured zone, and the surface discoloration may be quite extensive without any deleterious effect on the flavour or general eating quality of the fruit being noticeable until a considerable period has elapsed. The lesions are very unsightly, however, and greatly affect the market value of the fruit.

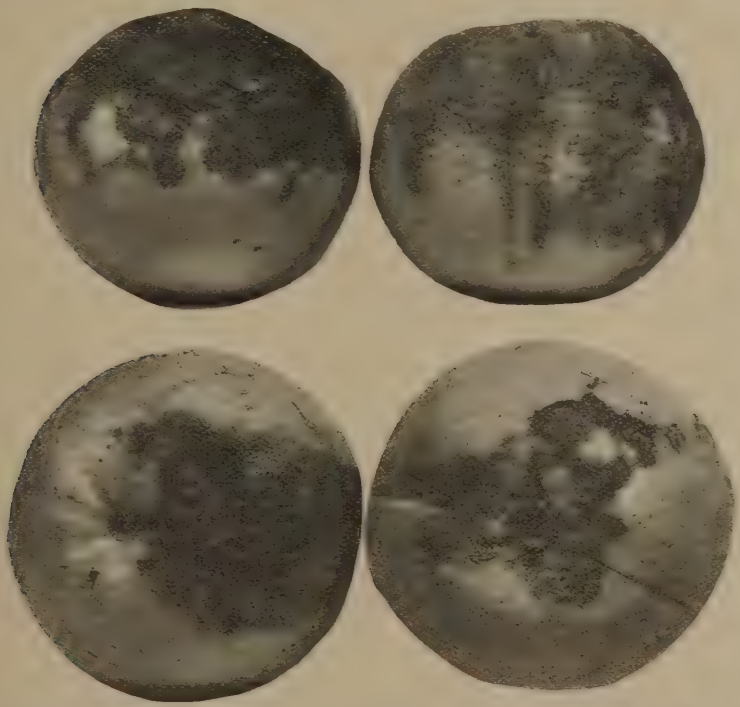

Fig. 5.—"Anthracnose" or "Stem-end Browning" of navel oranges, caused by the fungus *Colletotrichum gloeosporioides*. The top two specimens are resting on their navel ends. The bottom two are so placed that their stem-ends face the observer. The association of the affected areas with the stem-ends of the fruits is thus made clearly manifest. "Tear-staining" is fairly obvious in the case of the two top fruits.

[*Photo. by Govt. Printer.*]

One of the worst features of the trouble is that fruit may be packed in an apparently sound condition and show a considerable percentage of discoloured fruits when opened up a few days later at the market or in the shop of the retailer.

The diseased areas may make contact with the small circular depressed area where the stalk pulls away from the skin of the fruit, or there may be an irregular band of normally coloured (yellow) tissue around the point of attachment of the

stalk. Frequently the discoloured area touches the stalk depression at one or more points, and then extends asymmetrically for a considerable distance down and around one side of the fruit, without in any way affecting the opposite side.

Sometimes the lesions at one or more points show a "tear-staining" effect; long narrow promontories of diseased tissue extending from the larger diseased areas of the stem-half of the fruit, through the healthy yellow tissues, down towards the navel or stylar end. These look as thought caustic or corrosive tears had run down over the surface in narrow bands causing permanent stains.

Affected fruits may succumb readily to secondary infection with "blue moulds" (e.g., *Penicillium italicum* or *P. digitatum*), or they may gradually become more or less shrivelled without any sign of rotting of the interior. As they age, the diseased tissues tend to become darker in colour and somewhat depressed, and clearly marked off from the still-healthy yellow skin.

CAUSE OF THE ANTHRACNOSE OR STEM-END BROWNING DISEASE OF NAVEL ORANGES.

This disease is caused by the fungus *Colletotrichum gloeosporioides*, a parasite which is also responsible for a "die-back" and "withertip" condition of miscellaneous citrus trees, such as lemons, oranges, mandarins, etc. The fungus is exceedingly common in this State on citrus leaves and twigs which have died from any cause whatsoever, but it may also be definitely parasitic on leaves and twigs of trees which have been weakened in any way, such as by soil poverty, excess of water or mineral substances in the soil, frost, drought, severe exposure to cold or hot winds and so on.

A number of different strains have been isolated from diseased navel oranges in this State, and a multiplicity of strains have also been found in other parts of the world such as California and Florida, where the disease has been extensively investigated.*

Affected navel oranges are frequently to be found on the trees located just beneath dead twigs, or the dead stubs left behind by the dropping or picking of a previous season's fruits. These dead twigs and stubs, which are very common in most mature citrus trees, produce large numbers of acervuli (minute saucer-shaped fruiting bodies) which spill the fungal seeds (spores) in thousands during wet weather over the leaves or fruits below. It is thus that the "tear-stain" effect on the fruits is produced, as independent infection appears to occur at a number of points along the path covered by a drop of moisture in running down over the fruit.

The brown markings of the disease are most common on windfalls, but they may also be seen developing while the fruit is still adhering to the tree. There is no odour with this disease, and the appearance of the lesions is quite distinct from that of brown rot lesions.

It appears that a considerable proportion of the navel oranges dropping from the trees during July do so on account of infection taking place while the fruit is still on the tree, the discolouration only showing up after the fruits have been on the ground for some days. Infection while still on the tree appears to result in the attachment between the fruit and its "button" becoming so weakened that the weight of the fruit causes it to fall away, leaving the fruit stalk behind.

CONTROL OF ANTHRACNOSE OR STEM-END BROWNING OF NAVEL ORANGES.

The detailed measures necessary for the most satisfactory control of this disease have not yet been experimentally worked out, but the following steps would seem to follow logically from what is known of the etiological relationships (life-history, etc.) of the fungus.

* Fawcett, H. S., and Lee, H. Atherton:—"Citrus Diseases and their Control," McGraw-Hill Co., New York, 1926.

(1) As early as possible in the autumn, say about March in normal years, as much of the dead wood as possible, including small dead twigs, old fruit stubs, etc., should be cut out and burned, so as to destroy as much as possible of the sources of infection. It is important that this be carried out before the advent of heavy autumn rains, so as to prevent millions of fungal seeds (spores) being formed during wet weather on the dead wood.

(2) The trees should be well opened up, to allow of the ready penetration of light and air, by the removal of an odd healthy branch here and there, so that the fruit, twigs, and leaves etc., will dry off, as soon as possible after rain. Moisture and fungal diseases go hand in hand, and the longer the susceptible tissues remain in a wet condition, the greater, other things being equal, will be the losses incurred.

(3) As soon as possible after the heat of summer is more or less definitely past, and, if possible, before the onset of the heavy autumn rains (in other words about the middle to the end of April in normal seasons), *and provided that the trees are not suffering from lack of moisture*, spray the trees at least two-thirds of the way from the bottom upwards with 4-4-40 home-made Bordeaux mixture, plus a suitable spreader, being careful to thoroughly spray the inside area of the tree as well as the peripheral region (which is usually all that is satisfactorily done). If more than two-thirds of the tree is sprayed it will be imperative to add from half to three-quarters of a gallon of prepared white spraying oil per every 40 (forty) gallons of spray, or otherwise there will probably be a serious outbreak of scale insects shortly afterwards, owing to the killing out, by the Bordeaux mixture, of beneficial fungi which parasitise the scales. The oil will prevent this and also act as an excellent spreader to the Bordeaux.

It must be distinctly borne in mind that anthracnose does *not* start from the ground each year, as does Brown Rot of Citrus (see section on Brown Rot earlier in this article), *but the anthracnose fungus is already present in every part of the tree on dead twigs, etc., when the autumn rains commence.* Spraying to control anthracnose must therefore be much more thoroughly and conscientiously carried out than is usually the case for the Brown Rot disease.

(4) A further similar spraying may be necessary at the beginning of June, if the fruits are not well covered with spray at that time.

(5) If the drainage is defective this must be improved. It has been observed that the anthracnose disease is more serious, other things being equal, on properties where water lies about on the surface of the soil for some considerable time after rain.

(6) The trees must be kept in a vigorous condition by the use of adequate and "well balanced" fertilisers, the growth of leguminous (pea family) green manure crops in the winter, good drainage, conscientious cultivation, and timely and adequate irrigation, if necessary, in the summer.

9. BLACK SPOT OF PEARS.

The economic losses due to the "Black Spot" or "Scab" disease of pears—a disease which is widespread in Western Australia—are the result of the growth within the infected tissues of the causal fungus (*Venturia pirina*) and the eventual production of the summer spores (or "seeds"), in the stage of the life-history known as *Fusicladium pirinum*, in dark velvety masses on the fruit, leaves and young twigs. These spores spread the disease during the summer. They are produced from a mycelium (the thread-like body of the fungus), which lives just below the surface of the leaves, twigs and fruit. When the infected leaves fall in the

autumn this mycelium penetrates the deeper tissues of the leaf and produces numerous globular, open-mouthed fruiting bodies, known as *perithecia*, which mature by the following spring, when they produce a different type of spore called *ascospores*, which infect the developing leaves and fruits with the disease and thus complete the cycle.

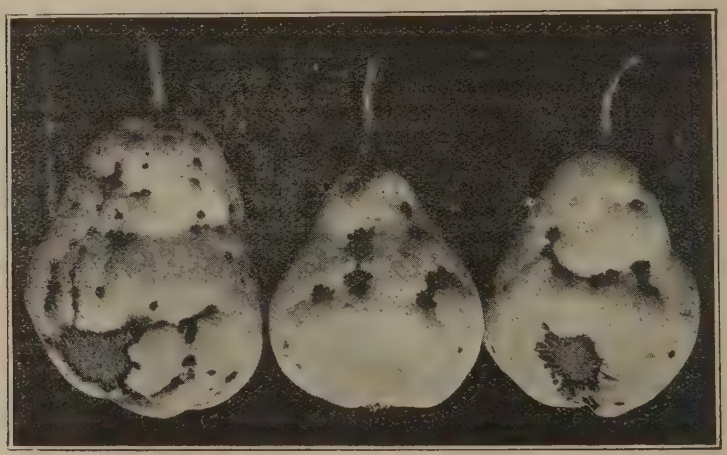

Fig. 6.—"Black Spot" or "Scab" of "William's Bon Chrietien" or "Bartlett" pears, caused by the fungus *Venturia pirina* (*Fusicladium pirinum.*)

[*Photo. by author.*]

CONTROL OF BLACK SPOT OR SCAB OF PEARS.

The disease can be readily controlled by pruning out infected wood during the winter; ploughing the orchard early in the spring so as to *completely* bury all fallen leaves a week or more before the first sign of breaking of the dormancy of the trees; by spraying with 5-4-50 Bordeaux mixture at the bud-bursting stage; and with Bordeaux mixture 3-4-50, at *each* of the following stages, viz., "pre-pink" to "pink," "petal fall," and "ten days later than petal fall." Experiments carried out at Sounness Bros., "Merryup" Orchard, Mt. Barker, by Miss Joan Hearman, in 1932, showed that an additional spraying with 3-4-50 Bordeaux mixture a month later still, improved the control. For example, on Glou Morceaux an improvement resulted from 79 per cent. perfect fruit to 89 per cent. perfect, with 93 per cent. grading either perfect or "plain," this latter term being used according to the definition of the Commonwealth export regulations. A considerable amount of the remaining 7 per cent. were so lightly affected as to be readily saleable on the local market.*

10. POWDERY MILDEW OF APPLES.

This disease, caused by the fungus *Podosphaera leucotricha*, has been present on apple trees in Western Australia for many years. The Superintendent of Horticulture, Mr. Geo. W. Wickens, can well remember when it was a disease of

* Hearman, Joan:—"Control of 'Black Spot' or 'Scab' of Pears in Western Australia," Journal Dept. Agric., W.A., Vol. X. (2nd series), No. 2, pp. 292-316, June, 1933. (Reprinted as Leaflet 380.) A more detailed account of the life-history of the fungus, etc., than given in the text above, will be found in "'Black Spot' or 'Scab' of Apples and Pears in Western Australia," by H. A. Pittman, Journal Dept. Agric., W.A., Vol. 7 (2nd series), pp. 241-263, June, 1930. (Reprinted as Bulletin 306.)

minor importance in this State, being confined principally to young Northern Spy stocks in nurseries. At a later period, which he believes was in 1907, he noticed that it was showing up in a number of orchards in the South-West and that it was to be found mainly on Rome Beauty, Five Crown and Northern Spy, but that it was not causing much damage. Since then it has spread little by little until now

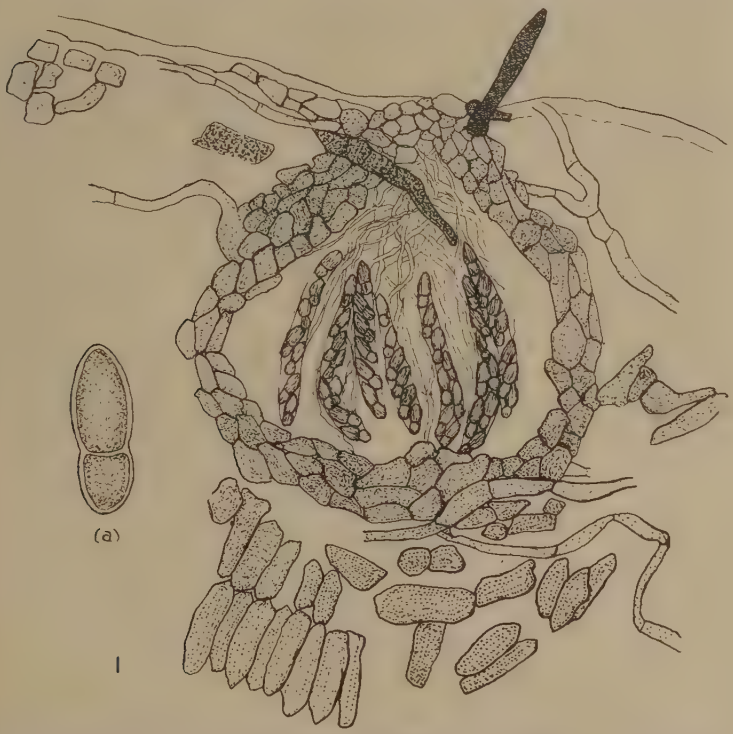

Fig. 7.—Transverse section of an almost mature fruiting body (*perithecium*) of the "black spot" or "scab" fungus of pears, *Venturia pirina*, in an over-wintering pear leaf. Note slipper-shaped 2-celled *ascospores* in their sacks called asci. Note also bristles at apex of *perithecium*. Magnified × 385.

[*After John Hearman, this Journal, June*, 1933.]

there is probably not a single orchard in the State completely free. Some are badly affected, others only in a minor degree, but taken in the aggregate the disease is causing considerable loss to the industry.*

At the present time this is the only fungal disease of apple trees in Western Australia for the control of which spraying or dusting of the foliage and other above-ground parts is required. This may account to some extent, at least, for the rather indifferent way in which its control is attempted.

Being free of the worries of codlin moth and black spot or scab of the apple, as indicated at the beginning of this article, and having of recent years his woolly aphis adequately controlled by the parasite *Aphelinus mali*, which was introduced

* Wickens, Geo. W. :—"Apple Powdery Mildew," Journal Dept. Agric., W.A., Vol. IX (2nd series), No. 3, pp. 392-393, September, 1932. (Reprinted as Leaflet 363.)

to the State by the activities of the Government Entomologist, Mr. L. J. Newman, in 1923, the Western Australian apple grower has not been forced to regard systematic spraying or dusting as a routine and an inescapable part of the process of growing his product, which is the case in probably every other apple-growing country of the world.

No variety is known to be immune in this State, but Cleopatra, Jonathan, Nickajack, and Rome Beauty are amongst the worst, whilst Yates and Dunns are two of the most resistant.

Trees badly attacked by powdery mildew present a very sickly appearance and may become partially or almost completely defoliated. The parasite attacks leaves, shoots, blossom-buds and fruits. On the leaves irregular, white, powdery patches may appear on either upper or lower surfaces or both. The white patches may spread until the whole of the leaf is covered with the superficial growth of the fungus. On the lower side of the leaf the fungus may be difficult to distinguish at times, owing to the very hairy nature of the lower sides of the leaves in some varieties. Infected leaves often roll inwards towards the mid rib and appear longer and narrower than healthy ones.

Fig. 8.—Portion of outer layer of cells (*epidermis*) removed from "Beurre Bosc" pear leaf, showing two fungal threads and a *conidiophore* budding off a *conidiospore* (summer spore). Note *stoma* or breathing pore in leaf. Magnified × 770.

[*After Joan Hearman, this Journal, June,* 1933.]

Ultimately they become brownish, more or less extensively dried out, and brittle. Then they crack readily and may eventually fall away from the stem.

Infected shoots have a very conspicuous white appearance, owing to the superficial covering formed by the fungal filaments and conidiophores (short stalks bearing fungal seeds or spores in chains, in this fungus). Such diseased shoots may be killed back from the ends for a considerable distance.

Infected blossom buds are smaller than healthy ones and are covered with the white fungal growth so characteristic of this disease. Blossom and leaf buds may be killed out. Dropping of young fruits may be caused and russetting followed by cracking may occur on affected fruits which remain hanging to the tree. The fungus is said to be an "ectoparasite" ("ecto" meaning outside), as it lives for the most part on the outside of its host, absorbing nourishment by means of special

absorbing structures called *haustoria,* which penetrate the internal tissues and function in much the same manner as the roots of ordinary plants. The fungus is carried over the winter in the form of "hibernating mycelium" (overwintering fungal threads) in infected shoots, or possibly also as spores caught in the scales of flower and fruit buds.

When the disease first appears on an orchard it is rarely treated as being of any great consequence, as very few shoots may be attacked and the general health of the trees may not appear to be affected to any serious degree until the disease has been present for a number of years. The effects of the disease are slow, insidious, cumulative and sure. Ultimately, if neglected, very considerable defoliation and dying back of leaders, laterals and fruit spurs may result as a direct effect of attack, or indirectly because of the gradual loss of vigor in the tree.

CONTROL OF POWDERY MILDEW OF APPLES.

1. Early in the winter all twigs, fruit spurs, or terminal buds showing evidence of the presence of the fungus, in the form of the characteristic white discolouration, should be pruned away several inches, if possible, below the lowest obvious sign of infection, before the distinction between affected and healthy shoots becomes obliterated, or obscured, by the weathering processes. All these prunings should be burned.

2. Any infected shoots or buds overlooked during the winter pruning should be cut out and burned as soon as they become obvious by reason of the development of the characteristic whitish covering in the spring. These prunings should also be burned.

If the above two control measures were conscientiously carried out from the time when the disease first made its appearance in an orchard, there would be very little necessity for any other control methods, as the chief source of carry over from season to season appears to be by means of over-wintering fungal threads in the twigs and buds. Unlike most fungi, spores seem to play a comparatively insignificant part in overwintering the powdery mildew of apples.

Some few growers who have had the disease on their properties for many years, and have allowed it to become serious on some of their trees, when advised as above state that if they were to cut out all the infected wood there would be very little of the tree left. They are, therefore, somewhat in the position of a person, who, having taken no effective steps to combat the early manifestations of cancer, eventually finds himself so overriden with the disease that to completely remove the trouble would be to extinguish the vital spark itself. Such a condition of affairs, however, is no argument that the early removal of diseased tissues is not practicable or effective.

3. In addition to the above, spray with Lime-sulphur, 1 to 15, plus ½lb. calcium caseinate spray spreader to every 50 gallons of spray at the "delayed dormant," "bud-bursting," or "spur-bursting" stage.

4. Spray with Lime-sulphur, 1 to 40 to 50, or Atomic sulphur, 10 lbs. to 80 gallons, at the "pre-pink" to "pink" stage, using calcium caseinate spray spreader at the rate of ½lb. to every 40 or 50 gallons of spray.

5. Spray with Lime-sulphur, 1 to 50 to 60, or Atomic sulphur, 10 lbs. to 100 gallons at the "petal fall" stage, using calcium caseinate spray spreader at the rate of ½lb. for every 50 or 60 gallons of spray. Do not spray if the shade temperature is above 75° Fahr.

Any subsquent sprayings (or dustings) with sulphur compounds under the climatic conditions prevailing in Western Australia are decidedly risky, as, should the shade temperature rise to about 90 degrees Fahr., within even a fortnight *after* spraying (or dusting) considerable damage may result to fruit and foliage.

The guiding principle should therefore always be the use of preventive treatment (*i.e.*, recommendations 1 to 5 above) as an annual *routine* procedure, and not a tardy and possibly harmful stable-locking policy when the proper opportunity has long since departed.

6. In instances where the trees have become so badly infected already as to require very extensive pruning to remove all the infected wood, it would probably be the best plan in the long run, to re-work them, by the strap-grafting, or multiple-graft, or multiple-bud method, with those varieties which experience has indicated to be the least affected on the property or in the district concerned.

7. Each season fertilise liberally with sulphate of potash, as this will, if persisted in, increase the resistance of the trees to the powdery mildew, increase the photosynthetic (food manufacturing) efficiency of the foliage, increase the quality of the fruits and the fruitfulness of the trees, give increased resistance to cold and drought, and increase the resistance to lime-sulphur injury during periods of high temperature.

8. It may be an advantage at times to thin out some of the large healthy branches, so as to allow plenty of light and air to circulate freely through the interior of the tree and so dry up the moisture on the leaves, etc., as soon as possible after rains, fogs or dews. Warm muggy weather is favourable to the development of powdery mildew.

9. The drainage, if defective, should be improved, so as to reduce if possible any excessive atmospheric humidity in the immediate neighbourhood of the trees which is so favourable to this disease. Powdery mildew fungi as a group require less moisture to become serious than other fungi, but even here, within limits, the greater the atmospheric humidity, provided it is accompanied by warmth, the more troublesome is the parasite.

11. ONLY HOME-MADE BORDEAUX MIXTURE RECOMMENDED.

In conclusion, wherever Bordeaux mixture has been recommended throughout this article is has been the *home-made variety only* that has been referred to. In all the formulæ given, the first figure means pounds (lbs.) of bluestone, the second figure means pounds (lbs) of freshly-burnt quick-lime, and the final figure means gallons of water. Leaflet No. 314, Second Edition, dealing in detail with the preparation of home-made Bordeaux mixture is obtainable free, on application to the State Department of Agriculture, St. George's Terrace, Perth.*

Citrus trees should not be fumigated with hydrocyanic acid gas, or with any substance which liberates this gas, until at least six months (and preferably longer) have elapsed after the use of Bordeaux Mixture. On the other hand, spraying with Bordeaux Mixture may proceed after the use of substances liberating hydrocyanic acid gas, provided that a fortnight has elapsed after the fumigation before the spray is applied.

* This information may also be found in an article entitled "Bordeaux Mixture—The Most Commonly Used Fungicide," by H. A. Pittman, in this Journal, Vol. IX. (2nd series), No. 4, pp. 542-554, December, 1932.

THE EFFECT ON BODY WEIGHT AND WOOL GROWTH OF FEEDING SULPHUR TO MERINO SHEEP.

E. J. Underwood,
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INTRODUCTION.

Free sulphur, in the form of brimstone and mixed with treacle, has been used as a mild laxative for man from time immemorial. In animals it is used in large doses as a laxative, and in smaller doses for certain affections of the skin. It is also used externally in various forms and mixtures in the treatment of mange in all species of animals. In very large doses sulphur is a poison, producing strong irritant effects evidenced by colicky pains and powerful purgation.

Free sulphur is unacted upon by the acid gastric juice of the stomach, but in the intestines it is partially converted into alkali sulphides which act as intestinal stimulants, and thus have a laxative effect. Most of the sulphur consumed is excreted in the faeces unchanged, but the small amount of alkali sulphide formed may be excreted in three other ways. It may be oxidised to alkali sulphate and passed out in the urine, or reduced to the gas sulphuretted hydrogen, and excreted both in the breath and through the skin. It is this capacity of sulphur for partial excretion through the skin that makes it valuable in the treatment of certain skin diseases.

Recently, however, mainly through experiments conducted in South Africa by Steyn (1), attention has been turned to the possible value of sulphur not only as a medicine but as a food. It has long been known that wool and hair contain sulphur, an average sample of pure wool containing as much as 3 per cent. This sulphur, however, is not present in simple form, but combined as a complex organic substance known as cystine. It was thought that all the sulphur present in wool had to be supplied in the diet as the highly complex cystine. The work of Jackson and Block (2) has now shown that, in rats at least, the sulphur of the diet may also be effectively supplied in the form of another complex substance known as methionine. Steyn's experiments opened up the interesting and significant posibility that in sheep free sulphur might be acted upon to a certain extent by some of the large number of micro-organisms in the rumen or paunch, and perhaps synthesised by them into the required cystine. Little hope could be held out for this possibility from earlier experiments on small animals (Geiling (3)), but it was known that the rumen contained bacteria with marked synthetic powers. For instance, Bechdel (4) *et al*, have isolated an organism of the genus Flavobacterium from the rumen of the cow capable of synthesising the complex Vitamin "B," which most species of animals require performed in their food supply.

Steyn's experiments were designed to ascertain the amounts of sulphur which could be added without harmful effect to the diet of sheep in the treatment of a form of cyanide poisoning known as "Geilsikte." A fair degree of resistance to cyanide poisoning was found, but in addition considerable increases in live weight and wool growth were reported in the sulphur-fed sheep. The experiments were somewhat unsatisfactory from the point of view of testing the value of sulphur as a food supplement, as Steyn himself realised. The experimental sheep were all 4-tooth or full-mouthed merinos, yet their initial weights ranged from 55 to 116 lbs., and further, the very large weight increases shown by these mature sheep indicated that the ration fed during the experimental period must have been much superior to that obtained by the sheep before the experiment commenced. Nevertheless, the weight increases reported by Steyn were so large and varied so closely with the doses of sulphur given, and the

average wool yields of the sulphur-fed sheep appeared so much higher than the controls (10 to 40 per cent) that an experiment under Western Australian conditions seemed warranted.

Since the publication of the South African work, experiments have been conducted by Seddon (5) in New South Wales, and Peirce (6) in South Australia. Seddon used two groups of seven merino hoggets even in body weight, size and wool quality. These two groups were run together for two years on pasture, one group receiving 10 grms. sulphur per sheep three times weekly. The sulphur had no effect on either body weight or wool yield. In the experiment of Peirce, two groups of five mature sheep, selected for evenness of fleece weights and wool quality, were used. Both groups were given an artificial diet just above a maintenance ration but containing insufficient cystine, the sulphur containing constituent of wool, for normal wool growth. The addition of two grammes of sulphur per day to each sheep in one of the groups over a period of seven months gave no increase in wool growth or effect on wool quality.

DETAILS OF EXPERIMENT.

As information as to the effect of sulphur on growth as well as on wool yield was required, it was decided to use young merino wethers for the experiment. Accordingly, twenty weaners (aged 6-8 months) and twenty hoggets (aged 18-20 months) were selected from the flock at the Avondale State Farm, Beverley, weighed and divided into two even groups of twenty, each group containing ten weaners and ten hoggets. The range of live weights in each group at the commencement of the experiment were very similar. The range was as follows:—

Group I.—Controls.

Weaners—59-74 lbs. (average 66.9); hoggets—82-103 lbs. (average 94.9).

Group II.—Sulphur-fed Sheep.

Weaners—55-74 lbs. (average 63.2); hoggets—83-102 lbs. (average 94.3).

Throughout the experiment all the sheep were run together on ordinary pasture and stubble typical of the grazing of the district, and at rather less than normal rate of stocking. The sheep were brought into near-by yards three times weekly with the minimum of handling possible, and the sheep of Group II. given 5 grammes of sulphur each on each of the three days, making a weekly dose of 15 grammes (approximately ½ ounce) per sheep. The sulphur was given to each sheep through a small dry funnel so as to make certain that the correct amount was consumed by each animal. In addition, all sheep were weighed at monthly intervals. The experiment was carried out for a period of nearly ten months, commencing on 8th December, 1932, two months after shearing, and finishing on 26th September, 1933, when the feeding of sulphur was discontinued, the sheep shorn, and the wool yields of the two groups measured.

The season was fairly typical, except that the autumn rains were later in coming than usual. In consequence the dry food conditions of March and April were severe, and the green feed of June exceedingly scanty. From July to September the pasture available to the experimental sheep was ample and of fair quality, consisting principally of Cape Weed and Burr Clover.

RESULTS OF EXPERIMENT.

(a) *Body Weights.*

The mean monthly live-weights and range of weights of the weaners and the hoggets in each group are given in Table 1. The terms, "weaners" and "hoggets," will be used throughout, though at the end of the experimental period these animals have become hoggets and 4-tooths, respectively.

TABLE 1.—MEAN LIVE WEIGHTS OF SHEEP, IN LBS.

	8-12-32.	9-1-33.	9-2-33.	9-3-33.	10-4-33.	8-5-33.	5-6-33.	4-7-33.	3-8-33.	8-9-33.	26-9-33. (Shorn Weights).
Group 1 (Control)—											
Weaners	66·9	65·2	67·9	69·0	72·3	72·4	77·1	81·0	78·9	85·4	82·7
Range	(59–74)	(59-73)	(59-76)	(60-78)	(64-77)	(64-77)	(68-84)	(70-90)	(70-84)	(72–97)	(73-92)
Hoggets	94·9	89·8	92·4	89·6	92·7	91·8	96·1	99·5	95·5	101·9	99·3
Range	(82-103)	(76–97)	(79-107)	(76-100)	(79-102)	(78-100)	(80-107)	(86–109)	(80–104)	(85-110)	(84-107)
Mean of Group 1 ...	80·9	77·5	80·1	79·3	82·5	82·1	86·6	90·3	87·2	93·7	91·0
Group 2 (Sulphur)—											
Weaners	66·2	61·9	63·5	64·3	69·8	69·5	74·6	78·6	75·7	81·6	82·2
Range	(55–74)	(45–76)	(46-80)	(48-81)	(50–76)	(52–76)	(59–87)	(62–93)	(59–90)	(66–99)	(72-96)
Hoggets	94·3	88·3	91·1	89·5	91·7	90·3	95·4	100·3	97·2	103·7	100·0
Range	(83–102)	(80–99)	(84-105)	(78-103)	(82-104)	(79–100)	(87–106)	(93–109)	(88-108)	(96–115)	(90–114)
Mean of Group 2 ...	80·3	75·1	77·3	76·9	80·7	79·9	85·0	89·5	86·5	92·7	91·1

During the first month of the experiment there is a fall in mean live-weight in each group, the drop being slightly greater in the sulphur-fed sheep. However, the fall in weight of the hoggets of the Control group in the first month, *i.e.*, 6 lbs., is almost identical with the fall in weight of both weaners and hoggets of the sulphur group. During the following four months there is little fluctuation in the mean live-weights of the two groups, a small gain in weight of the weaners in each group being counterbalanced by a small loss in the weights of the hoggets. The 2 lbs. difference in favour of the control group noticeable in the first month is still apparent at this time, but it is not statistically significant, and cannot be attributed to any deleterious effect of the sulphur feeding. During these months it is apparent from the weights that the dry oaten stubble grazing has provided less than a maintenance ration for the hoggets and a little more than a maintenance ration for the weaners. Under such nutritive conditions the feeding of sulphur has had no beneficial effect.

At the June weighing both groups show an evenly distributed increase in live-weight of about 5 lbs., followed by a further general increase of about 4 lbs. in the succeeding month. Late July was exceedingly wet and cold, and there was an appreciable fall in live-weights in both groups at the early August weighing. This was followed by a good general increase during August and September, the weaners at this time being about 4 lbs. heavier, and the hoggets nearly 2 lbs. lighter in the control than in the sulphur-fed group. In each case this small difference is shown by statistical means to be due to chance alone, and not to the influence of the treatment given.

The shorn weights obtained on 26th September are of interest in showing the effect of the treatment on body growth as distinct from wool growth. Throughout the experiment the weaners gained an average of almost exactly 16 lbs. in body weight in each group, and the hoggets 4½ lbs. in the control group and 5½ lbs. in the sulphur group. These figures are remarkably similar for the two groups, and show quite clearly that the sulphur feeding has had no effect on the body-weight.

(b) *Fleece Weights.*

The mean fleece weights and range of fleece weights of the "weaners" and "hoggets" of each group are given in Table II. It must again be pointed out that at the time of shearing the sheep called weaners have grown into hoggets, and those described as hoggets have become 4-tooths.

Table 2.—MEAN FLEECE WEIGHTS, in lbs..

Group 1—Controls	Weaners	10·4	Range (8·5—13·2)
	Hoggets	11·8	Range (11·2—13·8)
Group 2—Sulphur	Weaners	10·3	Range (8·2—12·5)
	Hoggets	11·8	Range (10·2—14·0)

The figures of Table II. show that though the ranges of fleece weights are large in each group they are very similar in magnitude, and the mean fleece weights of the two groups, both with the "weaners" and with the "hoggets" are almost identical. It is obvious that the sulphur has had no effect on wool growth.

Samples of each fleece drawn from the shoulder were taken and shown to Mr. H. MacCallum, Sheep and Wool Expert of the Department of Agriculture. He reported no apparent differences in the two groups, except that the fleeces of the sulphur group appeared slightly heavier in condition. The qualities ranged from 56-70's, with a preponderance of 64's in each group. The wool was well

grown and appeared to be well nourished, though a number of tender fleeces were present in both groups. There was just as much tendency towards tenderness in the wool of the sulphur group as in the controls, both reflecting the poor nutritive conditions of March and April. As far as could be judged, therefore, from the limited data available, the sulphur had had no effect on wool quality.

SUMMARY.

A brief general survey of information concerning the effect of feeding sulphur to animals is given.

An experiment is described in which 40 merino wethers were divided into two even groups of 20, each containing 10 weaners and 10 hoggets, and run together on normal pasture and stubble for a period of 10 months. One group received five grammes free sulphur per sheep three times weekly throughout.

From the fleece weights and monthly weighings of the sheep, it was concluded that the feeding of sulphur under these conditions had no effect on bodyweight or wool growth.

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SOME NEW IDEAS ON NITROGEN NUTRITION OF PLANTS.

W. M. Nunn, B.Sc. (Ag.), Muresk Agricultural College.

The belief that inorganic nitrogen compounds—principally ammonia and nitrates—are the sole sources of nitrogen for plants, and that organic nitrogen must first be decomposed before it can be assimilated, has stood since the investigations of Leibig and Boussingault. Opinions have varied as to which of the two forms is most favourable, but the possibility of organic nitrogen being directly absorbed, has been generally rejected. Recent research by A. I. Virtanen of the Foundation for Chemical Research, Finland, has thrown new and definite light on the question, and has made it evident that the accepted opinion is in need of revision.

Experiments carried out with legumes growing in sterilised quartz sand showed that the plants grew more vigorously when innoculated with their specific nodule bacteria, but without nitrogen fertiliser, than when not innoculated but provided instead with an adequate supply of nitrogen in the form of ammonia or nitrates. Moreover, organic nitrogen compounds were found to be present in the sand, and must have been diffused from the nodules since no other nitrifying organisms were present. Thus the legumes grew better when drawing their nitrogen from the organic supply in the nodules than when dependent on an inorganic supply, and at the same time much organic nitrogen was allowed to diffuse into the sand.

When different cereals were grown together with the legumes, it was found that they could utilise the organic nitrogen diffused as above, one pea plant supplying enough nitrogen for itself and two oat plants—and all in an organic form. The growth of the oat plant was markedly impaired when the ratio of oats to peas was increased. Curiously enough, the growth of the pea was also impaired and obviously through a deficiency of nitrogen. This fact, it is suggested, indicates that the legumes obtain only part of their nitrogen directly from the nodules, while the other part consists of nitrogen compounds diffused into the soil and again absorbed by the roots.

Special experiments were carried out to ascertain the chemical nature of the nitrogen compounds which diffuse from the nodules. All were conducted under sterile conditions, so that no other micro-organisms could be present to decompose the compounds formed. The results showed that the diffused compounds contained neither ammonia nor nitrate but consisted solely of organic nitrogen mainly in the form of amino-acids.

Having ascertained that the nitrogen diffused was all in organic form, further extensive experiments were carried out to verify the above suggestion that non-legumes could utilise it as such. Peas and barley were grown together under sterile conditions. The barley was entirely dependent for its nitrogen on the organic compounds diffused from the nodules of the legume, and it thrived particularly well. These conclusive experiments prove that non-legumes can utilise the organic nitrogen diffused from the nodules of leguminous plants. It is evident then, that non-legumes growing together with legumes in nature could actually use such compounds without the latter being necessarily first broken down to ammonia or nitrates. This is in accord with the oft observed circumstance, that the inclusion of legumes with a cereal crop will, despite the extra competition, have no detrimental effect upon the cereal and possibly even enhance its growth.

It has also been shown that plants growing on soils rich in organic nitrogen, where decomposition takes place slowly, utilise organic nitrogen on a large scale. Both barley and peas grew in sterile cultures with soluble organic nitrogen substances as their only source of nitrogen. Similar experiments showed that the soluble organic nitrogen of stable manure can also be utilised by plants without preliminary bacterial breakdown.

Thus it seems conclusive that the old theory of nitrogen nutrition of plants, prevailing since Leibig and Boussingault, must be modified. The higher plants can readily utilise certain organic nitrogen compounds found in soils without these being first necessarily broken down by micro-organisms with the production of ammonia. The exact nature of, and the manner in which the plant utilises, the absorbed organic nitrogen compounds is not yet definite, but Virtanen suggests that enzymes of the plant cells might possibly split off ammonia from the organic nitrogen already in the root system, the ammonia being then used for the albumen synthesis of the plant. Such enzymes are actually found in plant material—the enzyme "Urease" which splits off ammonia from urea, and "Asparaginase" which splits the amide group from asparagine. It might also be possible that certain amino-acids are used for albumen synthesis without preliminary decomposition. It has been proved that with the organic nitrogen, plants also absorb certain carbon chain compounds which is not the case with nitrates or ammonium salts. The possibility that these carbon compounds might also be of importance to the life of the plant should not be overlooked, and time may show that much of our theory of plant nutrition is in need of revision.

MAIZE VARIETY TRIALS 1933-34.

H. G. ELLIOTT, Agricultural Advisor, Dairy Branch.

(Continued from pages 335-338, June, 1934 issue.)

The results obtained from the trials not completed at the time of publication of the previous issue of the "Journal" are as follow:—

SERIES 1.

		Hickory King.	Silver-mine.	Wellin-grove	Fitzroy.	Small Leaming.
A. Thompson, Denmark ...	Tons per acre ...	27	28	21	30	27
	Percentage Yield	100	104	78	111	100
Barton Langridge, Donnybrook	Tons per acre ...	28·09	...	19·90	31·40	22·99
	Percentage Yield	100	...	71	112	82

The average production of green material for Series 1 is given in the following table:—

Variety.	Tons per Acre.	Percentage Yield.	No. of Trials.
Hickory King	16·75	100	7
Silvermine	14·81	88	6
Wellingrove	14·45	86	7
Fitzroy	18·21	109	7
Small Leaming	16·86	101	7

SERIES 2.

		Hickory King.	Early White Dawn.	Early Morn.	Funks Early Yellow Dent.	90 Day (Flint).
A. S. Hilditch, Northcliffe ...	Tons per acre ...	17·39	13·34	16·99	21·08	17·48
	Percentage Yield	100	76·7	98	121	101
B. Langridge, Donnybrook ...	Tons per acre ...	28·09	...	17·61	30·13	...
	Percentage Yield	100	...	62	107	...

The average production of green material and the percentage yield for series 2 are given in the following table:—

Variety.	Tons per Acre.	Percentage Yield.	No. of Trials.
Hickory King	15·87	100	6
Early White Dawn	12·03	76	5
Early Morn	13·21	83	6
Funks Early Yellow Dent ...	16·18	102	6
90 Day (Flint)	12·20	76	5

The average for all trials is as follows:—

Variety.	Green Material—Tons per Acre.	Percentage Yield.	No. of Trials.
Hickory King	16·308	100	13
Fitzroy	18·212	112	7
Small Leaming	16·862	103	7
Funks Early Yellow Dent ...	16·182	99	6
Silvermine	14·808	91	6
Wellingrove	14·454	90	7
Early Morn	13·212	81	6
90 Day (Flint)	12·203	75	5
Early White Dawn	12·029	74	5

Seed.

Of the 13 trials conducted at various centres, only four matured seed and gave the following yields:—

Variety.	Bushels per Acre.	Percentage Yield.	No. of Trials.
Hickory King	43·0	100	4
Funks Early Yellow Dent ...	41·6	97	2
Small Leaming	41·4	96	2
Early White Dawn	36·1	84	2
Silvermine	34·3	80	2
Wellingrove	31·4	73	1
90 Day (Flint)	30·8	72	2
Fitzroy	30·4	71	2
Early Morn	29·8	69	2

The results of the experiment for the first year indicate that at present no departure from the stand variety "Hickory King" can be recommended for either seed or green material.

These trials are being conducted again this season.

HORTICULTURAL NOTES.

Geo. W. Wickens, Superintendent of Horticulture.

EXPORT.

The quantity of fruit exported from Western Australia during the year ended 30th June, 1934, showed an increase of a little more than 102,000 cases when compared with shipments for year ended 30th June, 1933. In season 1932-33 the apple crop in the Mount Barker—Albany district—was badly affected by a visitation of thrips in plague form during blossoming time, and in consequence the quantity available for export was much below normal. In season 1933-34 apple trees cropped heavily throughout the same district; in fact, they produced sufficient to make up for a crop somewhat below average in other parts of the State, and the number of cases of apples exported increased by 114,182, from 504,052 to 618,234. The increase would have been greater if it had not been for the reduction imposed by regulation in the number of varieties permitted to be shipped, and the elimination of "plain" grade.

The pear crop was lighter in all districts, and the quantity exported this year showed a decrease of 13,198 cases, from 46,986 in 1933 to 33,788 in 1934.

The crop of table grapes varies less from year to year in Western Australia than any other fruit produced in the State, and the quantity exported annually experiences only slight changes. The difference between shipments in 1933 and 1934 was 1,622 cases: 44,685 cases being sent away in 1933 and 46,307 in 1934.

The only other kind of fruit than the three mentioned above that is exported from Western Australia in commercial quantities is the orange, and, unfortunately, owing to the difficulty of finding a payable overseas market, shipments are very moderate, ranging from 3,000 to 7,000 cases annually; last year 4,367, this year 3,860 cases.

Though complaints are often heard to the effect that sufficient enterprise is not shown in seeking overseas markets, the list of places to which Western Australian fruit is exported goes to show that the shipping agents who handle this phase of the industry do not go to sleep on the job.

Full particulars showing destinations and quantities are as follow:—

EXPORT OF FRESH FRUIT FROM WESTERN AUSTRALIA TO OVERSEAS MARKETS FOR YEAR ENDED 30TH JUNE, 1934.

Destination.	Apples.	Grapes.	Pears.	Oranges.	Lemons.	Quinces.	Peaches.	Plums.	Nectarines.	Passion Fruit.	Tomatoes.	Total.
	cases.	cases.	cases.	cases.	cases	cases.	cases.	cases.	cases.	cases.	cases.	cases.
London	208,215	10,260	29,346	1,258	146	32	5	22½	...	1	...	249,285½
Liverpool	36,072	399	...	...	...	...	...	...	...	...	...	36,471
Hull	10,075	...	...	...	...	...	...	...	...	...	...	10,075
Southampton	1,012	...	...	...	...	...	...	...	...	...	...	1,012
Glasgow	37,214	363	...	...	...	...	...	...	...	...	...	37,577
Hamburg	192,004	...	3,078¼	...	...	...	...	...	...	...	...	195,082¼
Rotterdam	15,346	...	...	...	...	...	...	...	...	...	...	15,346
Stockholm	64,351	1,978	708½	...	...	...	...	...	...	...	...	67,037½
Durban	1,830	...	...	...	...	...	...	...	...	...	...	1,830
Colombo	3,911	16,915	43	627	10	...	17	66	...	...	30	21,619
Bombay	937	407	...	60	15	...	...	...	...	...	...	1,419
Port Said	20,073	427	89½	150	...	...	...	...	...	...	...	20,739½
Aden	380	10	5	...	...	...	...	...	...	...	...	395
Port Soudan	100	...	...	...	...	...	...	...	...	...	...	100
Hong Kong	223	...	...	...	...	...	...	...	...	...	...	223
Calcutta	81	...	...	33	...	...	...	...	...	...	...	114
Haifa	229	...	...	...	...	...	...	...	...	...	...	229
Mauritius	60	72	...	65	...	...	...	...	...	...	...	197
Singapore	17,924½	10,812	371½	1,331	40	...	19	111	4½	...	...	30,613½
Penang	465	162	5½	...	...	...	...	...	...	...	...	632½
Sourabaya	1,302	1,085	...	20	...	...	...	5	...	...	...	2,412
Batavia	4,988	2,115	84	271	...	...	13	44	2	...	...	7,517
Samarang	1,430	666	12½	45	...	...	...	...	...	...	...	2,153½
Port Swettenham	12	4	2½	...	...	...	...	...	...	...	...	18½
Rangoon	...	624	42½	...	...	...	22	...	...	...	...	688½
Bali	...	8	...	...	...	...	...	...	...	...	...	8
Totals	618,234½	46,307	33,788¾	3,860	211	32	76	248½	6½	1	30	702,795½

ACREAGE AND PRODUCTION.

In season 1932-33 (latest figures available) the total area under orchards in Western Australia amounted to 20,124 acres, and in these days, when advice is being so freely tendered not only to cease increasing the area under fruit, but to take, and make, opportunities for reducing same, it is interesting to turn up old records and note that season 1915-16 was the peak year for orchards in Western Australia when the total amounted to 21,805 acres; from then a steady and regular decline took place until in season 1925-26 the area had been reduced to 18,358 acres—a reduction approximately of 3,500 acres. From that year a slow increase has taken place so that in 1932-33 the total area amounted to 20,124 acres, but was still less by 1,681 acres than in the peak year of 1915-16. It may be stated that fruit trees of non-bearing age comprised approximately 39 per cent. of the total area in 1915-16, whereas in 1932-33 they were approximately only 26 per cent., but consideration must also be given to the fact that in 1916 the population of Western Australia amounted to 308,806 persons, and in 1934 had increased to 442,521, or an addition in population of 43 per cent. In the years quoted the area under apple trees has varied more than that under any other kinds of fruit trees.

Particulars of variations in area of the principal fruits are as follow:—

	Season 1915–16.	Season 1925–26.	Season 1932–33.
	acres.	acres.	acres.
Oranges	2,861	3,047	2,807
Mandarins	267	184	166
Lemons	372	572	506
Pears	1,568	1,191	1,033
Apricots	713	717	678
Peaches	1,420	871	779
Nectarines	280	208	199
Plums	1,024	911	969
Apples	11,894	9,751	11,958

From the figures quoted it will be seen that apples and lemons are the only ones of the principal orchard fruits grown in Western Australia that had a greater area in 1932-33 than in 1915-16.

Full particulars of acreage and production of all fruits, including vineyards, for year ended 30th June, 1933, are as follow:—

FRUIT PRODUCTION AND AVERAGE FOR SEASON, 1932–33.

Orchards.

Kinds of Fruit.	Area.			Yield.
	Unproductive.	Productive.	Total.	
	acres.	acres.	acres.	bushels.
Almonds	47	154	201	3,038
Apricots	108	570	678	55,437
Apples	3,868	8,090	11,958	804,048
Bananas and Plantains ...	8	21	29	412
Figs	53	292	345	37,326
Lemons	54	452	506	58,067
Mandarins	24	142	166	15,324
Oranges	415	2,392	2,807	251,272
Other Citrus	14	21	35	2,180
Nectarines	53	146	199	14,471
Peaches	165	614	779	56,479
Pears	109	924	1,033	121,574
Plums	243	726	969	72,696
Quinces	14	78	92	8,607
Small Fruits	...	156	156	...
All other Fruits	38	133	171	...
Total ...	5,213	14,911	20,124	1,500,931

Vineyards.

Vines.	Area.			Yield.
	Unproductive.	Productive.	Total.	
	acres.	acres.	acres.	cwts.
Table Grapes	...	962	962	53,579
Wine Grapes	...	1,513	1,513	44,685
Drying Grapes	...	2,480	2,480	171,267
Not Bearing Vines ...	556	...	556	...
Total	556	4,955	5,511	269,531

TREES AND PLANTS BROUGHT INTO WESTERN AUSTRALIA FROM THE EASTERN STATES.

Inspections made of trees and plants entering the ports of Fremantle and Albany show that, in addition to those grown by local nurserymen, sufficient fruit trees were imported during the year ended 30th June, 1934, to increase the orchard area in Western Australia by 1,000 acres, allowing 100 trees per acre.

Full details are as follow:—

"PLANT DISEASES ACT, 1914."

Return of Fruit Trees and Plants Inspected at the Ports of Fremantle and Albany for Year ended 30th June, 1934.

Kind of Trees.	Fremantle.	Albany.	Total.
Apple	18,284	23,713	41,997
Apricot	2,718	588	3,306
Almond	2,344	104	2,448
Cherry	855	56	911
Fig	536	40	576
Lemon	5,975	55	6,030
Loquat	995	24	1,019
Mulberry	451	14	465
Nectarine	2,125	30	2,155
Orange	24,393	32	24,425
Peach	7,149	234	7,383
Persimmon	219	...	219
Pear	1,508	889	2,397
Plum	7,641	566	8,207
Quince	242	25	267
Other Nut	508	72	580
Ornamentals	26,365	225	26,590
Currant	507	125	632
Gooseberry	653	80	733
Loganberry	106	...	106
Raspberry	565	130	695
Bulbs and Roots	242,878	200	243,078
Strawberry	1,100	750	1,850
Apple Stocks	38,575	...	38,575
Pear Seedlings	2,000	...	2,000
Peach Seedlings	6,000	...	6,000
Totals	394,692	27,952	422,644

IMPORTATION OF FRESH FRUIT.

The importation of fresh fruit into Western Australia is small when compared with the quantity of fruit produced in the State, the biggest of the imported lines being bananas, and these no doubt will lessen as the plantations at Carnarvon increase in area and fruitfulness.

Details of inspections—State and Federal—are as follow:—

IMPORTATIONS OF FRESH FRUIT INSPECTED UNDER THE "PLANT DISEASES ACT, 1914," FOR YEAR ENDED 30TH JUNE, 1934.

Fremantle—		
Peaches	112	cases
Nectarines	146	,,
Lemons	462	,,
Pineapples	1,413	,,
Bananas	173	,,
Nuts	3,036	bags
Plums	8	cases
Cherries	2,592	,,
Passion Fruit	50	,,
Gooseberries	396	,,
Currants	3	,,
Tomatoes	10	,,
Mangoes	11	,,
Paw Paws	1	,,
Total	8,413	packages
Kalgoorlie—		
Bananas	3,092	cases
Passion Fruit	101	,,
Pineapples	396	,,
Tomatoes	973	,,
Oranges	580	,,
Peaches	1,742	,,
Cocoanuts	28	,,
Pomegranates	2	,,
Grape Fruit	4	,,
Nuts	89	bags
Plums	1,126	cases
Nectarines	812	,,
Lemons	416	,,
Apricots	179	,,
Cherries	969	,,
Gooseberries	69	,,
Mandarins	38	,,
Total	10,616	packages
Albany—		
Nil	Nil	

IMPORTATION OF FRESH FRUIT UNDER THE "QUARANTINE ACT" FOR YEAR ENDED 30TH JUNE, 1934.

Bananas	33,656	cases
Mangoes	16	,,
Pineapples	11	,,
Total	33,683	cases

MEADOW HAY.

H. G. ELLIOTT, Agricultural Adviser (Dairy Branch).

In the spring, when exceptional growth is obtained from our pastures, attention should be given to the conservation of fodders to tide over the long summer drought and early winter periods when grass growth is limited.

Two excellent forms of fodder conservation are meadow hay and silage. The former can be made and stacked cheaply, while the latter can be stored in pits, stacks, or silos at a very small cost per ton. It must be remembered, however, that a good reserve of both hay and silage is an insurance against bad seasons, and enables the farmer to increase the carrying capacity of his farm.

The gradual increase in quantities of hay and silage conserved per cow over the past three seasons is shown in the following table. These figures were obtained from the Better Dairying Competition conducted during the past three years.

	Reserve per Cow.					
	Hay.			Silage.		
	1933-34.	1932-33.	1931-32.	1933-34.	1932-33.	1931-32.
1—Average all Zones in Wet Districts	1·49	1·21	1·06	0·89	1·16	0·74
2—Average Zone 6 (Narrogin) ...	4·90	2·90	...	2·80	3·3	...

1—Receive 30ins. to 60ins. in rainfall
2—Receive 17ins. to 25ins. in rainfall.

Making Meadow Hay.

The value of meadow hay as a fodder for use, especially during the winter months, is gradually becoming a recognised fact for successful farming, and many farmers throughout the State are making a regular practice of keeping a portion of their pastures for this purpose.

Clover hay making often appears simple, but skill is required to obtain the best product, particularly when the weather conditions are uncertain. The aim of every farmer should be to obtain the maximum quantity of material rich in digestible nutrients.

Time to Cut.

The correct time to cut a clover pasture is when the bulk of the plants are coming into flower. Do not wait until full flowering, otherwise some of the valuable constituents of the product will be lost.

This is shown clearly in the following table. 100 lbs. of dry matter contains:—

	Digestible Crude Protein.	Production Starch Equivalent.	Phosphoric Acid.
	%	%	ozs.
Young Pasture 3ins. to 5ins. high ...	19	68	22·4
Hay stage Pasture (Flowering)	10·8	44	9·6
Mature stage Pasture (Dry)	4·5	30	6·4

From the above it can be seen that young clover is by far the best, but, as sufficient bulk would not be obtained for hay, it is advisable to cut it in the early flowering stage, as from then on to the mature stage a rapid decrease takes place in the valuable constituents. It also must be remembered that late cutting weakens the root stocks of young perennial plants, and prevents annual plants from producing an aftermath of good grazing value.

Ryegrass and Subterranean Clover being cut with a Special Divider.
[*Block by courtesy of J. Leith Gillespie.*]

Cutting and Handling.

A good mower with sharp knives, dividers, and a good swathing attachment is essential.

Leave each swath for a day or two to allow the exposed surface to dry sufficiently, after which it should be turned and left for a day to allow the other side to dry. After this operation the swathes are carefully put into windrows

A heavy crop of Subterranean Clover is difficult to handle.
[*Block by courtesy of J. Leith Gillespie.*]

and then carted into the stack, avoiding, if possible, cocking. Careful handling is essential to prevent damage to, and loss of, the fine leaves. Given favourable weather conditions the hay should be in the stack on the third or fourth day after cutting.

Rain has a considerable damaging effect on hay, and every endeavour should be made to harvest in fine weather, even though it may mean an early or late cutting. It must be remembered, however, that while early cutting may mean reduced weights of hay, it is offset to a great extent by increased aftermath growth. Late cutting means a losss in value of the product, also loss of leaf material. This is probably better than a crop cut at the right time and damaged by rain.

If the Swath is left in this condition it will cure well
[Block by courtesy of J. Leith Gillespie.]

Stacking.

The material should be spread evenly over the stack and well tramped to avoid the formation of air pockets, in order to control fermentation and drying out.

Heat will be generated and charring produced if the material is too green or too damp when stacked.

SODIUM ARSENITE AS A WEEDICIDE.

G. R. W. Meadly, B.Sc., Agricultural Adviser, Botanical Branch.

Sodium arsenite has been employed extensively for some considerable time as a weedicide, and until comparatively recently proved the most successful weed killer. During the last few years, however, chlorates, especially that of sodium, have become increasingly popular. Chlorates, being strong oxidising agents, are readily inflammable, and care must be exercised in this direction when handling them. On the other hand, arsenites, as well as being plant poisons, are fatal to animals if ingested even in small quantities. Chlorates of sodium and calcium are far less dangerous in this respect.

KILLING GREEN TIMBER.

The main treatment in which sodium arsenite is employed locally is the killing of green timber. Although the value of conserving a certain amount of timber on the farm must be stressed, when clearing is essential it is desirable to know the most efficient method.

Ring barking, if carried out thoroughly, is effective in most cases, but where time is an important factor the slow dying rate after this treatment alone causes inconvenience. When treated with sodium arsenite, however, the trees are killed much quicker and those which normally took months to die reach a similar stage in a few weeks. The actual time taken for the timber to dry, however, after the tree is dead is not appreciably affected by the presence of the arsenite. A number of our Eucalyptus trees also show a decided tendency to sucker, but if the chemical is applied under favourable conditions, this is reduced to a minimum. The most satisfactory time to carry out the work is when the tree is dormant, that is when the sap flow is at its lowest and the sap mainly located in the roots and lower portions of the trunk. Naturally the time of this condition varies with different trees and under different conditions, but in the South-West of this State the best time for application is from June to September.

At practically any time of the year a tree proper may be killed by ringing and applying sodium arsenite, but when the sap is down the tendency to form suckers is reduced.

THE MIXTURE.

Sodium arsenite may be purchased from wholesale chemists, but costs less if prepared on the farm. The following are suitable quantities for preparing a mixture to be used on green timber:—

1lb. white arsenic.
1lb. washing soda.
½lb. whiting.
4 gallons water.

White arsenic (arseneous oxide) is not readily soluble in water so that it is mixed with an equal weight of washing soda in order to convert it into water soluble sodium arsenite. The washing soda may be replaced by half its weight of caustic soda, but this is more expensive.

First dissolve the soda in a convenient amount of water, using heat if necessary to hasten the solution of the soda. Mix the white arsenic into a paste with water, and add slowly to the soda solution, stirring all the time. Place on a strong fire and boil for at least one hour, stirring from time to time. When the arsenic is all dissolved, add the whiting in the form of a thin paste and then make up to the required bulk by adding the necessary amount of water.

WARNING.

Avoid inhaling the fumes as far as possible owing to their unpleasant and injurious nature. Also do not allow the skin to come in contact with the mixture any more than is necessary owing to the caustic effect of the soda. Old gloves afford a certain amount of protection.

METHOD OF APPLICATION

By means of a series of downward strokes, "frill ring" the trees as close to the ground as possible. By making the axe strokes in one direction only and cutting into the heart wood, a frill is formed into which enough of the solution to run all around the frill is poured as soon as possible after the tree has been cut. For trees of 4 feet in diameter, about a quart of solution is required. This is easily applied by means of an old kettle or teapot, or a kerosene tin fitted with a tap and tube. The whiting included in the original solution serves to mark the trees which have been treated.

Every care should be taken with the solution as it is a virulent poison. Stock should be withheld from the treated paddock for at least three weeks after application. Vessels used in handling the solution should be retained for that purpose only, and kept out of the reach of children.

In order to secure satisfactory results it is essential that the work be carried out in a thorough manner. If the frill ring is not complete, or the solution not poured around the whole of the frill, good results cannot be expected.

KILLING WEEDS.

Besides being used for killing green timber sodium arsenite is also used for killing weeds growing on paths, etc. In this case the strength used depends upon the type of weed to be attacked. In the case of a strong growing perennial weed such as Nut Grass (*Cyperus rotundus*), 1lb. of white arsenic, 1lb. of washing soda, and 4 gallons of water gives a suitable solution, but for weak growing weeds such as Chickweed (*Stellaria media*), a 1.1.30 solution proves effective under favourable conditions. The solution may be applied by means of a watering can.

Weedicides such as arsenites and chlorates are often useful for killing weeds in small areas, especially gravel paths and tennis courts which cannot be dug up conveniently. On larger areas, however, where the weeds may be controlled by cultivation, poison sprays are not economical.

M. T. PADBURY TROPHY COMPETITION.

I. THOMAS, Superintendent of Wheat Farms.

The details of the judging of the following entries, which were shown as incomplete in the results of this competition published in the June issue of the Journal of Agriculture, have since been finalised, and are as follow:—

Order of merit in complete list.	Competitor.	Address.	Rainfall during growing period.	Area harvested.	Yield.		
					Gross.	Average per acre.	Average per inch of growing period rain.
			points.	acres.	bus. lbs.	bus. lbs.	bus. lbs.
3rd ...	Haggerty, H. J.	Yarding ...	761	308·0	7,386 45	23 50	3 9
26th ...	Butcher, O. J. ...	Pithara ...	1,378	244·5	6,629 54	27 7	1 58

The results of the entries of these competitors since the inception of the competition are shown below:—

Competitor.	Address.	Average yield per acre per inch of growing period rain.			
		1930.	1931.	1932.	1933.
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
Haggerty, H. J. ...	Yarding	2 51	*	*	3 9
Butcher, O. J. ...	Pithara	*	*	2 42	1 58

* No entry.

THE TUNG OIL TREE.

(*Aleurites Fordii, Hemsl.*)

C. A. GARDNER, Government Botanist.

The Chinese wood-oil or Tung-oil tree, is a native of central and Western China, but is now cultivated commercially in various other countries, especially the United States of America. It is a deciduous tree which attains a height of 25 feet, and produces fruits somewhat the shape of a small orange, two to three inches in diameter. Each fruit contains three to seven firm brown seeds from which the oil is extracted.

The tree apparently shows little predilection in the matter of soils, but prefers well-drained hillside soils which are slightly acid. The type found most suitable in Florida is a sandy soil or sandy loam, which is underlaid with clay at a depth of from three to eight feet. The rainfall should not be less than 30 inches, 50 or even 70 being preferable. Experience in other parts of the world indicates that the Tung tree is comparatively resistant to dry conditions and high summer temperatures.

The oil expressed from the nuts is used especially in the manufacture of paints, varnishes and water proofing materials. Large quantities are also utilised in insulating compounds for cables, etc., and in dressing for leather and the manufacture of soap.

In 1931, one thousand seeds of this tree were obtained from the Royal Botanic Gardens, Kew, for trial purposes locally. These seeds were distributed to various parts of the State including Hamel, Bridgetown, Salmon Gums, Bencubbin, Broome, and Perth, but the results so far obtained are disappointing. A fair germination was secured at Broome, but the young plants were dried considerably by the hot winds. Apart from the Forests Nursery at Hamel, which raised 126 plants, no encouraging reports have been received. The young plants raised have been distributed to various places in the South-West, but results at this stage cannot be considered satisfactory. Two young plants in the Government Gardens are alive, but are not vigorous in their growth.

The local information so far secured regarding the Tung tree does not enable us to definitely advise regarding it, but the limiting factor seems to be the hot dry summer weather. The portion of the State most suited for the growing of this tree appears to be the South-West, but certainly further trials would have to be made before planting could be reasonably commenced on a commercial scale.

COST OF FEEDING COWS UNDER THE AUSTRALIAN OFFICIAL PURE BREEDS HERD RECORDING SCHEME, WESTERN AUSTRALIA, 1933-34.

G. K. BARON-HAY, Superintendent of Dairying.
R. A. PAUL, Herd Recorder.

In pursuance of the policy of the Dairy Branch initiated 11 years ago of recording the monthly fodders consumed by herds, which are checked on the occasion of the visits from the Herd Recorder, figures have been calculated with a view to ascertaining the average cost of feed for producing 1 lb. butter fat and 1 gallon of milk. In arriving at these costs, the various foodstuffs have been evaluated at the average prices ruling during the year, which are shown in Table 1.

TABLE 1.

Prices used in Valuing the Foodstuffs Consumed During Year Ending June, 1934.

	£	s.	d.
Chaff (oaten or wheat), per ton	4	8	0
Clover Hay, per ton	3	0	0
Silage, per ton	0	7	0
Wheat (crushed), per bushel	0	3	0
Oats (crushed), per bushel	0	1	11
Bran, per short ton	5	10	0
Pollard, per short ton	5	17	6
Linseed, per ton	12	10	0
Grains, per 75 lb.	0	0	6
Green Lucerne, per ton	1	0	0
Green Maize, Sudan Grass and Cereal Crops—			
(Chaffed), per ton	0	6	0
(Grazed), per head per week	0	2	6
Pasture, per head per week	0	1	6

During the last four years the cost of feed to produce 1 lb. of butter fat has approximated 7¼d. per lb. and 3½d. per gallon of milk respectively, which is in marked contrast to the relatively high costs during the previous seven years. This indicates that owners of studs are studying carefully the cost of feeding their herds with the view of keeping this as low as possible and within economic limits. This is shown in Table 2 hereunder.

TABLE 2.—PURE-BRED COWS UNDER OFFICIAL TEST.

Average Results for last Eleven Years.

Year ending 30th June :	Average Milk Yield per Cow.	Average Butter Fat per Cow.	Average Cost of Feed per Cow.	Average Feed Cost to Produce 1 lb. of Butter Fat.	Average Feed Cost to Produce 1 Gallon Milk.	Average Value of Butter Fat per lb.
	gals.	lbs.	£ s. d.	pence.	pence.	pence
1924	600	319·50	10 4 10	7·7	4·09	19·5
1925	652	308·59	14 13 2	10·77	6·15	17·5
1926	624	312·01	14 14 7	11·15	5·66	19·0
1927	602	290·72	14 10 5	12·00	5·79	19·0
1928	592	280·56	15 11 4	13·34	6·34	19·5
1929	629	295·10	15 1 0	12·24	5·74	20·0
1930	636	294·98	14 10 3	12·74	5·10	19·5
1931	643	301·6	9 14 7	7·74	3·64	16·0
1932	696	318·96	10 18 3	8·21	3·76	14·0
1933	664	308·6	9 2 3	7·08	3·29	11·0
1934	720	333·7	10 2 6	7·28	3·37	10·0

It will be seen that the cost of feeding for the current year shows a slight rise over that for 1933, which is in part accounted for by a rise in the price of chaff (8s. per ton) and clover hay (5s. per ton). It also will be seen that the average production of cows for 1934 is higher than in any previous year, being 8.4 per cent. above that for 1933. It, therefore, would be expected that the feed cost for producing butter fat and milk would be lower per lb. in view of this higher production. The reverse, however, was the case, as the cost of producing butter fat showed an increase of 2.8 per cent. This is an indication that mere high production may not mean higher net profits unless the cost of feeding is scrutinised carefully by the farmer throughout the year.

With the unprecedented low price of butter fat during the past year, strenuous efforts are being made by farmers to reduce the cost of production, the greatest individual item of which is the cost of feeding.

One method by which costs have been reduced and yields increased is by a greater use of silage for feeding during the summer months. By means of this

fodder, herds situated in dry districts, such as Nungarin, Northam, York, Geraldton, and Koojan have been able to produce average yields comparable with those of herds more favourably situated geographically.

Table 3 shows that, with the use of silage, the cost of producing butter fat can be reduced approximately 9 per cent.

TABLE 3.

VALUE OF SILAGE IN FEEDING.

Cost of Production.	(A) With Silage.*	(B) Without Silage.†	Per cent. in favour of Silage.
	d.	d.	%
Cost of Feed per 1lb. Butter Fat produced	7·16	7·81	9
Cost of Feed per 1 gallon Milk produced	3·60	3·77	4·7

* 12 Herds. † 7 Herds.

Without silage, it is believed that the production of good records in dry areas would be impossible without increasing the cost of production beyond what would be economically sound.

Table 4 shows that, for the 10 herds situated in the drier areas mentioned above, the cost of producing butter fat was 8.02d. per lb., whereas in the South-Western districts the average cost for the nine herds concerned was 6.7d., or approximately an increased cost of 20 per cent. for feed in the drier areas. This is a very serious disability, and indicates very clearly that in areas where green fodders are not available, the lactation periods of cows should commence early in the autumn, preferably in April or May, so that the nine months' period may be completed by December.

TABLE 4.—COST IN LIGHT RAINFALL AREAS COMPARED WITH HERDS IN THE SOUTH-WEST.

Average of—	Production.		Cost of Feed for—	
	Milk.	Butter Fat.	1 Gallon Milk.	1 lb. Butter Fat.
	lb.	lb.	d.	d.
Dry Areas (10 Herds)	7,518	353·2	3·90	8·02
Wet Areas (9 Herds)	6,427	314·6	3·39	6·70

As in previous years the three breeds under test have been compared as regards cost of feed for the production of milk and butter fat as shown in Table 5.

TABLE 5.—BREEDS COMPARED AS PRODUCERS OF MILK AND BUTTER FAT.

Breed.	Average Yield of Butter Fat per Cow.	Average Test.	Average Yield of Milk per Cow.	Average Cost of Feed per Cow.	Cost of Food to Produce 1 gallon of Milk.	Cost of Food to Produce 1 lb. of Butter Fat.
	lb.	%	lb.	£ s. d.	d.	d.
Jersey (8 Herds) ...	313·2	5·2	6,023	9 0 9	3·60	6·92
Guernsey (5 Herds) ...	341·1	5·1	6,605	10 17 3	3·94	7·64
Illawarra Shorthorn (6 Herds)	346·5	4·0	8,589	10 8 6	3·05	7·56

As is to be expected, the Jersey breed led as far as the economic production of butter fat is concerned, while the Milking Shorthorn excels as an economic producer of milk. When, however, the relative merits of the breeds are considered from the point of view of ultimate disposal as carcase meat and also the value of vealers and steers, the matter of which breed should be advocated becomes one entirely of individual preference.

Tables 6 and 7 give the herds under test in order of merit as producers of butter fat and as producers of milk.

TABLE 6.- HERDS IN ORDER OF MERIT AS PRODUCERS OF BUTTER FAT.

Herd.	Area—W, Wet; D, Dry.	Breed.	Average Production of Butter Fat per Cow for 9 months.	Available Skim Milk per Cow.	Value of Butter Fat at 10d. per lb.	Value of Skim Milk at 1d. per gallon.	Gross Return for Fat and Skim Milk.	Cost of Feed per Cow for 9 months.	Profit per Cow by Sale of Butter Fat.	Cost of Feed to produce 1lb. of Butter Fat.
			lb.	lb.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	d.
A	D	Guernsey	442·4	5,372	17 1 2	2 2 9	19 3 11	13 7 3	5 16 8	7·24
B	D	Jersey	400·5	4,785	15 6 3	1 19 11	17 6 2	13 6 0	4 0 2	7·97
C	W	Guernsey	397·3	5,160	15 2 9	2 3 0	17 5 9	10 7 4	6 18 5	6·26
D	W	Jersey	386·1	4,846	14 16 8	2 0 5	16 17 1	9 13 6	7 3 7	6·01
E	D	A.I.S.	377·1	6,899	14 14 3	2 17 6	17 11 9	7 12 4	9 19 5	4·84
F	D	do.	374·4	7,178	14 13 0	2 19 10	17 12 10	10 16 9	6 16 1	6·94
G	W	do.	361·4	6,413	14 1 2	2 13 5	16 14 7	10 14 5	6 0 2	7·12
H	D	do.	353·7	6,100	13 14 9	2 10 10	16 5 7	12 7 1	3 18 6	8·38
I	D	Jersey	339·3	4,218	12 17 9	1 15 2	14 12 11	12 3 9	2 9 2	8·62
J	W	do.	323·1	4,060	12 5 11	1 13 10	13 19 9	8 10 7	5 9 2	6·33
K	D	Guernsey	316·4	3,884	11 18 8	1 12 2	13 10 10	11 3 6	2 7 4	8·47
L	W	do.	315·0	3,720	11 17 6	1 11 0	13 8 6	9 12 8	3 15 10	7·34
M	D	A.I.S.	314·0	4,720	12 0 0	1 19 1	13 19 1	13 4 9	0 14 4	10·11
N	D	Guernsey	310·0	3,866	11 13 4	1 12 3	13 5 7	10 5 0	3 0 7	7·93
O	W	Jersey	307·9	3,625	11 11 8	1 8 0	12 19 8	5 17 0	7 2 8	4·56
P	D	do.	304·5	3,244	11 6 8	1 7 0	12 13 8	12 6 4	0 7 4	9·70
Q	W	do.	275·4	2,634	10 3 4	1 2 0	11 5 4	9 7 6	1 17 10	8·17
R	W	A.I.S.	235·4	3,293	8 15 2	1 7 5	10 2 7	7 9 7	2 13 0	7·62
S	W	Jersey	229·7	2,650	8 6 8	1 2 1	9 8 9	7 17 8	1 11 1	6·93
Average...			333·7	4,744	12 14 1	1 19 6	14 13 7	10 2 6	4 11 1	7·28

Skim Milk available for use (after rearing Calf) = [(Milk Production — 60 gallons) — 10%] — 120 gallons.

TABLE 7.—HERDS IN ORDER OF MERIT AS PRODUCERS OF MILK.

Herd.	Breed.	Average Yield of Milk per Cow for 9 months.	Value of Whole Milk at 1/- per gallon.	Cost of Food per Cow for 9 months.	Profit over Cost of Feed.	Cost of Food to produce 1 gallon Milk.
		lb.	£ s. d.	£ s. d.	£ s. d.	d.
F	A.I.S.	9,909	43 8 7	10 16 9	32 11 10	2·86
E	do.	9,599	40 19 10	7 12 4	33 7 6	1·90
G	do.	9,059	38 5 10	10 14 5	27 11 5	3·10
H	do.	8,711	36 11 2	12 7 4	24 3 10	3·36
A	Guernsey	7,902	33 5 3	13 7 3	19 18 0	4·05
C	do.	7,666	31 16 7	10 7 4	21 9 3	3·24
D	Jersey	7,317	30 1 9	9 13 6	20 8 3	3·17
B	do.	7,250	30 0 0	13 6 0	16 14 0	4·40
M	A.I.S.	7,178	29 1 10	13 4 9	15 17 1	4·42
I	Jersey	6,620	26 12 0	12 3 9	14 8 3	4·44
J	do.	6,444	25 14 6	8 10 7	17 3 11	3·17
K	Guernsey	6,249	24 14 11	11 3 6	13 11 5	4·29
N	do.	6,229	24 12 11	10 5 0	14 7 11	3·95
L	do.	6,066	23 16 7	9 12 8	14 3 11	3·81
O	Jersey	5,961	23 6 0	5 17 0	17 9 0	2·35
R	A.I.S.	5,592	21 1 3	7 9 7	13 11 8	3·21
P	Jersey	5,538	21 8 9	12 6 4	9 2 5	5·33
S	do.	4,878	17 17 9	7 17 8	10 0 1	3·87
Q	do.	4,860	18 1 0	9 7 6	8 13 6	4·63
Average		7,204	29 8 6	10 2 6	19 6 0	3·37

TABLE 8.

Summary of Results, 1933-34.

The average pure bred cow under official test produced in nine months:—

(1) 7,204 lb. milk.
(2) 333.7 lb. butter fat.

	£ s. d.
Value of Butter Fat @ 10d. per lb.	12 14 1
Value of Skim Milk @ 1d. per gallon	1 19 6
Total return	14 13 7
Cost of Food for 9 months	10 2 6
Net Return from Sale of Butter Fat	£4 11 1
Value of Whole Milk @ 1s. per gallon	29 8 6
Cost of Feed	10 2 6
Net Return by Sale of Whole Milk	£19 6 0
Cost of Feed to produce 1 lb. Butter Fat	7.28d.
Cost of Feed to produce 1 gallon Milk	3.37d.

STALLION SUBSIDY SCHEME.

In order to assist the draught horse breeding industry in this State, particularly with the object of providing good quality horses for farm work, the Government in 1928-29 made available a sum of money from which subsidies would be paid for the purchase of approved stallions, the settler only being required to pay half the landed cost of the animal. This subsidy has been continued each year since that time, including the present year, and up to date 91 horses have been obtained, the majority from the Eastern States, and distributed widely. There is no doubt that this policy has had an appreciable effect on the quality of our farm horses. This will be realised when it is stated that the animals purchased must have a Government certificate to the effect that they are free from any hereditary or transmissible unsoundness or disease, and are registered in the stud book.

In order that the animals may be fully utilised it is also provided in the conditions under which the subsidy is granted that the horses must travel in the districts in which they are situated for at least three years, and that the maximum fees to be charged shall be—

Ordinary service	£4 4 0
Guaranteed service	£6 6 0

and the owners of the stallions are required to advertise these conditions in three consecutive insertions in the local Press.

The following is a list showing for whom horses were purchased this year, and the approximate landed cost:—

	£
E. Ludeman, Wattening—"Newbold Belmont"—Sire "Brunstane Demand (21591 C.S.B.), Dam "Widgiewa Winsome" (2019 C.S.B.)	210
Senator P. J. Lynch, Three Springs—"Fyvielea Pearl" 2636 N.Z.C.S.B. Sire "Fyvie Baronet" (21071 C.S.B., imp.), Dam "Violet Morocco" (4853 N.Z.C.S.B.)	200
N. Lemmon, Ongerup—"Cracksman" 2743 N.Z.C.S.B.—Sire "Hero Bold (2168 N.Z.C.S.B.), Dam "Lorraine" (3158 N.Z.C.S.B.)	200
W. Waddell, Carrabin—"Veradale Roderick" -Sire "Everlasting Dale" (616 C.C.S.B.), Dam "Veradale Rosie Dale" (2563 C.C.S.B.)	180
Nelson Pearce, Mingenew—"Roselyn Radiant"—Sire "Melrock Roy Dale" (1290 C.C.S.B.), Dam "Dunira Tilly"	290
Chivers, H., Yandanooka—"Oakleigh Brown Kinloch"—Sire "Kinloch Hero" .. (2176 N.Z.C.S.B.), Dam "Dorah Douglas" (1893 C.C.S.B.)	190
Metcalf, H., Dowerin—"Gallant Treasure"—Sire "Bright Treasure" (575 C.C.S.B.), Dam "Lady by Fabric Again" (617 C.C.S.B.)	170
O'Connor Estate, Toodyay—"Oakdale Balnakill"—Sire "Buchlyvie's Choice" 110 C.C.S.B.), Dam "Lady Glendale" (1835 C.C.S.B.)	330
Taylor and Sons, Dangin—"Brackenhurst Monarch"—Sire "Vue Dale" (772 C.C.S.B.), Dam "Madame Dale" (1391 C.C.S.B.)	140
S. Hunter, Yandanooka—"Anama Cashier"—Sire "Scottish Banker" (20647 C.S.B.), Dam "Widgiewa Iris" (1644 C.C.S.B.)	180

MULLA MULLA.

(*Trichinium alopecuroideum,* Lindl.)

A Native Forage Plant.

C. A. Gardner, Government Botanist.

Several species of the genus Trichinium, one which is purely Australian in distribution, are valued forage plants in the arid and semi-arid parts of the continent. In the North-West and North they form a valuable portion of the herbaceous forage on stock runs, and stock appear to seek after the plants in preference to most other species, including grasses. One of the most wide-spread and best known of the species is the one dealt with herein—*Trichinium alopecuroideum,* the common Mulla Mulla of the pastoral areas. The range of this plant extends from Kimberley almost to the south coast, and inland to the eastern boundary of Western Australia. Having such an extensive range it is known to most pastoralists, and recently the plant is becoming known in the agricultural districts, especially in the lighter soils of the wheat lands which it is successfully invading, although much handicapped by the fact that stock keep it in check through eating it down, thus giving it little chance to spread. It thrives on ploughed sand-plain soils, and in the lighter granitic loams of the eastern districts.

The species assumes two distinct forms, according to soil and climatic conditions. The common form of the South-West and Eastern Districts is an almost shrubby perennial herb attaining a height of three or more feet, possessing a strong tap-root and numerous almost woody spreading stems, from which arise erect herbaceous branches bearing soft leaves and spikes of greenish-yellow flowers at first erect, but as they elongate becoming drooping in the upper portions. All classes of stock, but especially sheep and horses, are fond of the leaves and flowers.

The northern form, which is found from the East Murchison northwards, is a smaller plant with a few stiffly erect herbaceous stems and wide cylindrical erect spikes of yellowish flowers. The plants rarely exceed eighteen inches in height, and possess little in the way of foliage except the basal leaves. With this form of the species it is principally the flower-heads which are of value as forage.

The Mulla Mulla is being spread principally through the agency of stock, and to a less extent the seeds are wind-borne. The flowers in the fruiting stage expand their segments, and being light, the whole is easily carried by wind. Stock perhaps distribute the seeds in part through their droppings, and in part through the seeds in the flowers adhering to wool or hair. In the light sandy ploughed soil of the sand-plains the plant has found a suitable environment, and allowed to seed readily spreads itself. Its value in the drier areas is that it thrives under conditions which are too dry for most forage plants, or in soils of the poorest quality agriculturally, and that it makes vigorous growth during the dry period of the year when most feed is scarce.

Seeds of Mulla Mulla are not obtainable commercially. The plants produced from seeds are relatively few when the production of seeds is considered. This may be due to the low production of viable seeds, or that the conditions necessary for their germination are not met with everywhere. Where plants are in existence it is advisable to allow them to produce seeds occasionally, and to encourage the plants to spread in unused ground rather than to attempt establishment by obtaining seeds.

"Mulla-Mulla." (Trichinium alopecuroideum, Lindl.) Kellerberrin.

EXPLANATION OF PLATE.

A. Habit. B. Leaf. C. Flower-spike. D. Flower with two basal bracteoles. E. Flower opened, showing internal structure.

Kellerberrin, W.A. *Icon. origin.*

EXPORT EGGS.

G. D. SHAW, Poultry Adviser, Department of Agriculture

The export season is in full swing and it will be of advantage to review the activities.

Eggs are arriving for export in increasing quantities each week, and there is a marked improvement in cleanliness and packing, but it must be impressed upon producers that any egg showing the slightest stain is rejected and paid for as an "export reject." A little more care would help to keep down the numbers of eggs condemned.

It has been stressed that eggs should be collected twice daily and wiped with a damp cloth. By wiping immediately the eggs are collected the advantage of the animal heat of the egg helping to dry the moisture from the damp cloth is retained, and the egg dries immediately it is wiped. Do not allow the eggs to stand all day or overnight, as it needs a double process of handling, wiping with a damp cloth and drying with the dry one.

Stains.

Stains are the result of several causes. The most prevalent being fouled nesting material.

A stain which has been allowed to "dry in" the shells cannot be removed. It can be erased while cleaning, but will certainly show up after the egg is dry. These stained eggs, although fresh, cannot under any pretence whatever, be classed as clean. They do not look inviting and if they were exported would not enhance the reputation of our eggs overseas.

Misshapen Eggs.

Misshapen eggs fall into the producer's crate with regular precision only to be rejected on inspection at the export floors. If producers would only understand that a misshapen egg is due to some mismanagement, and eliminate the trouble, they would help themselves considerably.

Whole lines have come forward with ridges around the centre, which is caused more or less by bad breeding. Continued hatching of misshapen eggs results in an increase in the succeeding generation. Do not breed from a misshapen egg.

The long thin egg, the round one, that with a ridge, and the egg which is all crinkles, are classed as misshapen and are all caused through breeding faults.

Thin Shells.

Thin shells are now a fault which will increase in the near future, due to the shortage of shell forming material in the bird's body.

Plenty of shell grit does not necessarily mean good shells. Bonemeal in large quantities may not mean an improvement in shell texture. The improvement will only come about by the bird's ability to assimilate the shell grit and bonemeal into her body. She will eat plenty but may not be able to use it.

The hens may need a tonic; therefore, as the season develops look to the condition of the birds and regularly examine the egg for shell texture. If the flock is in good condition the addition of more bonemeal will be an improvement and it should be added until it is found there are superficial spots of lime on the egg. The supply can easily be adjusted from that point.

Watery Whites.

The term "watery whites" is hardly understood by either the average producer or consumer.

Consumers have a bad habit of classing any egg whose albumen is weak and watery as a stale egg. It has often been found that the newly laid egg when broken into a frying pan, has run all over the pan as if stale. That watery condition of the white has led to the classification of "stale" which is an injustice to many an honest producer. No trouble has been taken to observe the yolk. A new laid yolk stands right up inside the white, but the stale yolk shows a distinct flat lifeless appearance.

Watery whites cannot be seen by the candling process. Watery whites are said to be caused by the wrong feeding of green material. Very seldom are they noticed in eggs from a farm which regulates the feed scientifically.

Where fowls can obtain an over-abundance of succulent green feed so one can expect "watery whites."

Broken Down Air Cells.

Broken down air cells are often called "watery whites" but the causes are totally different.

It is now universally advocated that all eggs should be packed "big" end up, which allows the contents of the egg to be retained in its natural way. If the eggs are packed with the air cells downwards the contents are resting on the tender membrane of the air cell. Vibrations, due to rough handling and transport, cause the contents to rest heavily on the air cell, and the membrane is drawn away from the shell. When candled the air cell works around the egg and is of little use for export if badly damaged. With big end downwards, heavy vibrations may rupture the air cells and the air then mixes with the contents and causes bubbles to join in the egg.

A few years ago, we were advised to pack air cells downwards as any cracked egg retained its contents and did not stain its neighbours. The results of recent years have convinced packers of the fallacy of this advice, as more eggs are damaged through having "wobbly" air cells than through the stains due to cracked eggs.

Stale Eggs.

The summer is fast approaching, and already eggs of doubtful age are arriving on export floors. Produce must be marketed frequently and despatched through the shortest channel to the export floors.

A marked improvement has been noticed in receipts from country storekeepers. The eggs are coming forward fairly frequently, and there is no excuse for not forwarding twice a week at least.

Rejects.

Keep all known "rejects" out of your export consignments. They must certainly be marketed but label them separately. Be fair to the purchaser of those rejects by labelling the contents what they are and not what you would like them to be.

A recent incident of an unfair designation will appeal to most producers.

It was necessary to inspect a case of eggs recently with a view to condemnation. The case was labelled "Standard" New Laid, meaning that every egg was laid within 7 days, and all clean and of 2ozs. and over in weight. On examination, the case was found to contain nothing but cracked and filthily stained eggs, certainly under 7 days old, but the grade was anything from 1½ozs. to 2½ozs. That case was labelled "Standard" New Laid Eggs. A glaring case of misrepresentation under the Agricultural Products Act, 1929. Such eggs could only come under the third grade of goods, and should have been classed as "cooking" eggs.

THE OLEANDER.

(*Nerium Oleander*, Linn.)

A Decorative Shrub and Toxic Plant.

C. A. GARDNER, Government Botanist.

The Oleander, commonly grown in gardens in many parts of the State, is valued as one of the most handsome of our summer flowering shrubs, the bright green foliage and single or double flowers of white, pink, or red, together with the sweet and heavy perfume, making it attractive, especially in country districts. The plant is very hardy, and, when once established, will thrive in dry localities with very little water under conditions in which the White Cedar or so-called Cape Lilac has difficulty in growing. The plant may be seen on many stations through the Murchison, Gascoyne, and Ashburton districts, and there is no reason why it should not be cultivated more extensively in the wheat areas.

Although the species is so familiar, it is perhaps not generally known that the plants are highly toxic, and cases of poisoning, both in animals and the human species, are by no means rare, and thus it is important that care should be taken with children plucking the blooms, in case they might be eaten, and stock should be excluded from areas where the plant is grown. Local cases of poisoning are on record from stock having eaten leaves from the shrubs. The flowers, leaves, wood and roots are all poisonous, and Professor Henslow records that during the Peninsular War a number of French soldiers who went out foraging near Madrid returned laden with the fruits of their search, and that one of the number, with a view of securing some wood to make skewers for the meat, cut a quantity of Oleander boughs, and having stripped off the bark, used the wood in the meat. The result was that, out of twelve who ate the meat, seven died, and the rest were dangerously ill. The poisonous principle is said to be so subtle that its exhalations alone have been known to cause serious accidents and even death to those who sleep for any length of time under its influence.

The Oleander is native to India, and is supposed to be the willow of Scripture.

Farmers and others are warned against admitting stock to areas in which the plant occurs, especially if feed is scarce.

"Oleander"

Nerium oleander

"TOXIC PARALYSIS" OR BOTULISM IN SHEEP AND CATTLE.

A. McK. Clark, L.V.Sc.,
Chief Veterinary Surgeon.

The attention of sheep and cattle owners is drawn to the presence of this disease, which is the cause of serious mortality amongst their flocks and herds during the summer months. It is especially in evidence in the Wheat Belt. The losses are considerable, and it may even be said that toxic paralysis takes the greatest toll of all diseases during the year. The purpose of this article is, therefore, to give due warning to those owners whose sheep and cattle have been, or may be, affected with this troublesome disease in order that steps can be taken to prevent losses from this cause during the coming summer. The reason for toxic paralysis becoming more evident is attributed to the following:—

(1) Long dry summer—(Lack of minerals in pasture).

(2) Lighter distribution of superphosphate—(Less mineral in the soil).

(3) Greater number of dead rabbits—(Infected carcases available for ingestion).

Causes.—This disease is prevalent in many of our districts amongst cattle owing to a mineral deficiency in the food supply. Milking cows in particular constantly require supplies of phosphate in order to remain healthy. Cattle will attempt to make good their mineral requirements, when pastures are deficient, by chewing bones, which are rich in the necessary elements. If mineral deficiency is very marked the animal's appetite becomes more and more depraved, with the result that all kinds of rubbish is eaten. There is in most districts a germ (*Bacillus botulinus*) which occurs in the soil and infects carcases of animals—cattle, sheep, rabbits, etc. It is found, and, by reason of its great resisting powers, may remain for considerable periods, in bones of dead animals. This bacillus or germ produces a powerful toxin or poison. When the bacilli or toxins are ingested (with bones or parts of carcases which are infected with them), particularly by cattle, in the great majority of cases fatal results ensue. Carcases of animals which have died from the disease are, of course, very dangerous. The disease produced is sometimes known as "Dry Bible" or "Toxic Bulbar Paralysis."

The rabbit carcase-eating habit is developed in sheep owing to continued feeding during the long dry summer on stubble and other pastures which are deficient in phosphates. It will not become evident in the winter months, but usually in the middle or end of the summer.

In order that this disease may occur on a property two factors are essential—

(a) Mineral deficiency.

(b) Presence of bacillus botulinus.

SHEEP.

Symptoms.—Sheep mostly affected are young sheep and in good condition. In some cases the initial symptoms appear to be wriggling of the tail as though fly-blown. Later they show a stiff gait and a disinclination to move, progressing only for a short distance and then lying down. The animal appears dull and does not attempt to eat. When standing, the head is held in a drooped position, frequently with the lower jaw hanging down. From the open mouth a more or less profuse flow of saliva occurs. In advanced cases respiration is spasmodic and abdominal. Finally the animal is unable to rise, and dies quietly without a struggle. The mortality is usually in the vicinity of 10 per cent.

Prevention (remedying deficiency).—Cure by treatment is not known, therefore preventive measures, which are known to be successful, should be adopted. It is essential that the full mineral requirements of sheep during the summer months be supplied in order that the craving for rabbit carcases and other debris be satisfied. It is estimated that the optimum daily intake of phosphoric acid for two-tooth ewes weighing 80 lbs. is about ⅛ oz. For 100 sheep for a week this would be 5½ lbs. The amount of phosphoric acid which 100 sheep would obtain, in one week, from our summer pasture, is about 3 lbs., and in parts of the wheat belt may be even less. This leaves a deficiency of 2½ lbs. of phosphoric acid. This would be provided in 14 lbs. of dicalcic lick having an 18 per cent. phosphoric acid content. This should, therefore, be taken as a minimum amount of lick to be provided in the wheat belt. That is approximately ⅜ oz. of dicalcic lick containing not less than 18 per cent. phosphoric acid per sheep per day.

Oats.—Oats are often fed to sheep in this State, and it is interesting to note the phosphoric acid content of this important feed. 1,000 lbs. of oats contain 8 lbs. of phosphoric acid. If oats are fed at the rate of 1 lb. per sheep per day they will supply in one week to 100 sheep about 5½ lbs. of phosphoric acid; this is the required amount of minerals.

Licks.—The question is, therefore, "What lick to use?" It has already been pointed out that this should be a *dicalcic lick containing not less than* 18 *per cent. phosphoric acid.* Bonemeal has been used with success for this purpose, but it has been shown by recent investigations that dicalcic phosphate, weight for weight, is three times as effective as bonemeal. Therefore dicalcic phosphate is the most economical and efficacious mineral to use as a lick for the purpose of supplying the necessary minerals to sheep in order to prevent that craving for carcases and debris, and consequently prevent infection with the germ which is the direct cause of toxic paralysis. It is recommended, therefore, that sheep on the wheat belt be supplied with a lick, during the summer months, which can be made up as follows:

Commercial dicalcic phosphate	..	..	..	..	45	parts.
Commercial Salt	..	..	..	..	40	„
Molasses	..	..	..	..	5	„
Water to condition	..	..	..	..	10	„

In addition, of course, all rabbit carcases and bones should be collected and burned or buried deeply.

This lick is odourless and devoid of any taste and its purity is unquestionable. It should be supplied in wooden containers and placed near the water supply. If sheep are unaccustomed to licks, care should be taken to make them familiar with them. Should they disregard them the addition of a little oats or wheat germ will attract them. This may be excluded after the sheep take freely to them. It may even be necessary to yard the sheep at night, at the same time placing the licks in the yard with them. Phosphatic licks should not be taken away from sheep as a matter of course at the beginning of the winter, but should be continued until the sheep refuse to take them. In all cases they should be made available each year not later than September. It must be pointed out that where toxic paralysis is prevalent amongst sheep a lick containing not less than 12 per cent. phosphoric acid would be necessary in most cases. Also that because licks are taken freely is no indication as to their efficacy.

Other Beneficial Effects.—Apart from the losses sustained by sheep contracting toxic paralysis through the ingestion of infected material, a lack of phosphates in the food supply decreases the food consumption, with the result that an economic loss ensues through the sheep not making the best use of the available pastures.

CATTLE.

Symptoms. -Dairy cows are particularly affected, whilst despasturing; cattle during the summer months are affected to a lesser extent. Cows at the height of milk production require large quantities of minerals for milk secretion. The symptoms produced are due to paralysis of certain portions of the nervous system by the toxin (or poison) of the invading bacillus. In typical cases the animals are unable, or with difficulty, to masticate or swallow feed. In the early stages there is difficulty in drinking, later no feed or water is taken. There is excessive salivation and sometimes protrusion of the tongue. The gait is more or less staggering (partial paralysis), and the animal is dull. Rumination (cudding) is disturbed and finally suspended, and the faeces are scanty. Progressive weakness ensues, the animal lies down and can be got to rise only with difficulty or not at all. Eventually, in from two days to a week after symptoms are first noticed, the animal sinks into a state of coma (sleep) and dies. These characteristic symptoms are not always shown. In very acute cases death is sudden; other cases may be of longer duration than described, the affected animals showing general unthriftiness, loss of condition and a cripply gait. The bone-chewing habit is constant in all cases.

Prevention.—As treatment is of no avail, preventive measures should be adopted. In mild cases assistance can be given by giving a drachm of powdered Nux Vomica in the food supply three times daily. Drenching should not be attempted owing to the inability of the animal to swallow and the consequent possibility of choking.

Licks.—Prevent mineral hunger and the consequent depraved appetite by supplying phosphates. Bonemeal has been successfully used in the past but a cheaper substitute is now recommended, known as dicalcic phosphate. The latter is three times more effective in similar weights as bonemeal. Dicalcic phosphate should be given in quantities of 2 oz. per cow per day in the food supply, or in the form of a lick which is made up as follows:—

Commercial dicalcic phosphate	45 parts.
Commercial salt	40 „
Molasses	5 „
Water to condition	10 „

In the event of this lick not being freely taken by cattle, a little linseed meal should be added only until the necessary liking is developed.

All carcases and old bones should be removed from the paddocks which are carrying stock and buried deeply, or preferably burned.

METEOROLOGICAL INFORMATION.

STATIONS.	TEMPERATURE.				RAINFALL.		TEMPERATURE.				RAINFALL.		TEMPERATURE.				RAINFALL.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	JUNE, 1934.						JULY, 1934.						AUGUST, 1934.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	65·5	74·9	45·7	38·3	4·50	4·26	63·7	70·0	42·8	34·8	3·74	3·96	68·6	82·0	47·0	39·5	2·71	2·79
Geraldton	67·7	76·0	51·5	40·0	5·06	4·78	66·2	70·1	50·2	40·0	3·96	3·90	69·7	81·1	51·8	41·0	1·68	2·90
Walebing	61·6	61·1	43·6	37·1	4·19	4·03	60·0	65·8	40·1	31·4	3·59	3·78	63·7	75·0	43·3	34·0	2·27	3·13
Perth	63·9	73·0	48·9	40·5	11·41	7·01	63·0	68·6	46·9	37·2	5·88	6·74	65·5	76·0	48·5	40·2	5·65	5·74
Kalamunda	61·0	74·7	47·1	39·5	12·09	8·19	59·2	64·2	45·7	39·0	8·39	8·58	62·0	72·0	46·9	39·2	6·76	6·91
Bunbury	64·1	70·7	47·7	38·1	4·67	7·18	62·6	68·0	46·4	37·0	5·68	6·82	64·2	69·3	46·3	37·2	5·80	5·26
Bridgetown	61·5	71·5	42·0	29·2	6·46	6·03	60·9	66·5	39·6	31·2	9·24	5·79	63·2	73·0	39·6	32·2	4·44	5·10
Albany	62·6	70·0	49·5	38·8	5·93	5·48	61·1	69·3	47·7	40·0	5·90	5·60	63·2	72·0	46·8	39·4	6·32	5·28
Merredin State Farm	61·5	72·3	43·4	34·3	1·93	1·85	60·0	67·8	39·0	28·4	1·85	1·90	64·6	75·9	40·9	29·5	1·47	1·52
Northam	63·2	73·0	53·6	34·0	4·01	3·29	62·1	68·0	41·0	32·0	3·17	3·49	65·6	77·0	42·3	33·0	1·56	2·61
York	62·1	70·5	43·0	32·0	3·99	3·31	60·9	69·0	40·8	31·5	2·89	3·43	64·3	75·0	40·2	31·3	1·71	2·83
Narrogin State Farm	57·7	66·5	43·2	32·6	4·64	3·64	58·0	64·2	40·8	32·7	3·01	4·24	61·0	71·7	40·5	31·5	3·06	3·18
Katanning	58·9	65·6	44·2	31·7	3·41	3·00	58·0	64·7	42·0	31·7	2·92	3·10	60·8	70·7	41·0	30·7	2·46	2·47
Cape Leeuwin ...	63·3	74·5	53·7	48·0	9·62	7·06	62·0	52·3	67·6	47·0	7·99	7·32	62·5	69·0	52·5	45·0	6·39	5·28

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